REMEDIATION OF SPELLING DEFICITS IN MENTALLY RETARDED CHILDREN: COMPARATIVE EFFICACY OF OVERCORRECTION AND INTERSPERSAL TRAINING PROCEDURES

A thesis

submitted in partial fulfilment

of the requirements for the Degree

of

Master of Arts in Psychology

in the

University of Canterbury

by

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University of Canterbury

February 1986

CONTENTS

ACKNOWLEDGEMENTS

I am deeply indebted to my supervisor, Dr Nirbhay N. Singh for his advice, encouragement and guidance during the course of this study. I also thank the staff of Allenvale School and Hogben School, Christchurch, for their co-operation, and especially thank Judy Singh for her assistance. A very special thanks to Tracy Kendall for her superb assistance with data collection and to Robin Phillips for help in the preparation of this thesis.

To my parents and friends who supported and encouraged me, I am very grateful. I especially thank Warren for his companionship and support, particularly during the writing of this thesis.

Last, but by no means least, I thank all my subjects who made this research enjoyable.

ABSTRACT

This thesis investigated the comparative efficacy of instructional procedures to remediate spelling deficits in mentally retarded children. Three experiments are reported. In Experiment 1, the differential effects of overcorrection and interspersal training were compared against a no-training control condition. While both procedures were superior to the no-training control condition, children learnt to spell new or difficult words equally well or better through overcorrection than interspersal training. Experiment 2 investigated the effects of interspersing known words with unknown words. Overcorrection training was compared to overcorrection with interspersal training and a no-training control condition. Whilst children learnt to spell a large number of words during overcorrection training, the interspersal technique provided no additional assistance and hindered the progress of "poorer" spellers. In Experiment 3 overcorrection training was compared to the corrective procedure used during the interspersal training condition of Experiment 1 (the "Neef procedure"). Children showed equally large spelling gains during both overcorrection and the Neef procedure. This suggests that the Neef procedure is an alternative overcorrection procedure. These results are discussed in terms of future research in instructional procedures to remediate the spelling deficits in mentally retarded children.

GENERAL INTRODUCTION

Spelling can be defined "as the ability to recognise, recall, reproduce, or obtain orally or in written form the correct sequence of letters in words" (Graham & Miller, 1980 p.2). Spelling is a traditional curriculum area in the primary school, where a considerable amount of time and energy is devoted to its mastery. Despite this emphasis, a significant number of school-age children have difficulty learning to spell (Horn, 1969).

Prevalence

An early study by Fox and Easton (1946) indicated that almost half of the children in grades 2 to 8 lagged by at least a grade in their spelling skills. More recent studies confirm that spelling continues to be a problem for a large percentage of children (Ollendick, 1979). Indeed in New Zealand, as in the United States, there has been a national decline in spelling performance (Elley, 1976; Graham & Miller, 1980). While the extent of spelling difficulties with mentally retarded children is unknown, Weisberg (1981) has suggested that spelling deficits are compounded for mentally retarded individuals since their academic status, by definition, is below that of children of normal intelligence. Mental retardation is therefore likely to detrimentally affect spelling performance.

Traditional Approaches to Remediation

The literature on the development of spelling skills in children is extensive and presents a number of methods to teach and remediate spelling deficits. Some of the traditional procedures include Montessori's (1965) sensory approach, Schoolfield and Timberlake's (1960) phonetic system, Fernald's (1943) multisensory approach and more recently a morphographic approach (Dixon, 1979). While these programmes have been successful in the remediation of spelling deficits in some children, in general, spelling continues to be a widespread problem amongst school children.

Research reveals that instructional practices in spelling are influenced more by habit than research results (Graham & Miller, 1980). Fitzsimmons and Loomer (1977) found that teachers seldom use research-supported practices in their classrooms. Instead, more traditional, habitual methods are implemented. Thus the traditional weekly classroom spelling test is still the most common form of spelling instruction in most American schools (Rowell, 1972). Many of these traditional methods of spelling instruction have been found to be of little use in the improvement of spelling performance (Haring, Lovitt, Eaton & Hansen, 1978).

A number of these methods are those typically encountered by the handicapped learner in the mainstreamed setting (Strain & Kerr, 1981). The traditional weekly spelling test is one such teaching method that is likely to be ineffective, especially for mentally retarded children. Firstly, children do not learn at the same rate nor do they encounter the same difficulties in learning to spell. Therefore such a large, group-orientated instruction may benefit

only a few children (Graham & Miller, 1980). Secondly, research shows that the number of words to be studied in an individual lesson appears to be a critical variable in the performance of poor spellers.

Rieth, Axelrod, Anderson, Hathaway, Wood and Fitzgerald (1974) observed that students with poor spelling skills performed better on weekly review tests when they received a portion of the words each day and were tested daily than when they received all words at the beginning of the week and did not have daily tests. Reviewing a portion of the words each day without daily testing was also inferior to receiving a portion of the words each day with daily testing. A number of other studies support the positive effects of reduced unit size and distributed practice on spelling performance (e.g., Gettinger, Bryant & Fayne, 1982; Mirkin, Deno, Tindal & Kuehnle, 1982).

Behavioural Approaches to Remediation

Applied behaviour analysis first addressed itself to research on spelling in the late 1960's. Now a small but diverse literature on spelling has evolved (Kerr & Lambert, 1982). Concern has been focused on the development of effective teaching methods to improve spelling performance rather than to address such questions as what makes spelling difficult and which words should be selected by teachers for spelling lists so that optimum spelling performance occurs. This approach has received some criticism. For example, Kerr and Lambert (1982) have suggested that the failure to address such questions may hinder subsequent attempts to design sound instructional procedures. However, regardless of the debate

still surrounding this issue, applied researchers have developed a small number of effective remediation techniques for spelling.

The early applied studies established the effectiveness of a number of reinforcement programmes, at least in the short-term, of children with average intelligence. These include material incentives (Axelrod, Whittaker & Hall, 1972; Benowitz & Busse, 1976), tokens and points (Sulzer, Hunt, Ashby, Koniarski & Krams, 1971), group contingencies (Lovitt, Guppy & Blattner, 1969) and student-selected as opposed to teacher-specified contingencies (Lovitt & Curtiss, 1969; McLaughlin, 1982, 1983).

A small number of studies have also investigated the spelling tutor as a variable. The use of peers as change agents has been successfully evaluated with classroom spelling games (Axelrod & Paluska, 1975; Delquadri, Greenwood, Stretton & Hall, 1983). Peer tutoring programmes have been used with children of average intelligence but poor spelling ability (Dineen, Clark & Risley 1977; Harris, Sherman, Henderson & Harris, 1972), behaviourally disturbed adolescents (Stowitschek, Hecimovic, Stowitschek & Shores, 1982), and institutionalised retarded persons (Mulvaney, Fitzhugh, Wagner & Hughes, 1980). In addition, home tutoring programmes have successfully remediated spelling deficits in children of average intelligence (Broden, Beasley & Hall, 1978; Koven & LeBow, 1973).

Reinforcement contingencies alone are inadequate to deal with spelling difficulties in school children as they do not provide any formal training in spelling. This limitation combined with the availability of greater methodological

knowledge has since directed the attention of applied researchers to the identification of more effective methods of spelling instruction. In addition, research has extended to include the teaching and remediation of spelling with mentally retarded children. The instructional procedures that have been evaluated with mentally retarded children include imitation training, the Add-A-Word Spelling Programme, overcorrection, and interspersal training. Although the efficacy of these procedures has been established in only a limited number of studies, the data are very positive and strongly suggest that procedures exist which can improve the spelling performance of mentally retarded children. In addition, these procedures are likely to be more effective than currently used traditional procedures.

Imitation Training

A rather novel and seemingly counterproductive method of spelling instruction was investigated by Kauffman, Hallahan, Haas, Brame and Boren (1978). The effect of imitation of spelling errors was evaluated on the spelling performance of three mildly retarded pupils. Two teacher-mediated consequation tactics were alternated weekly across the six phases of each of two experiments. During the first condition of Experiment 1, a correctly written model was provided for misspelt words and the pupil was required to recopy the word from the model (model only). The second intervention (imitation plus model) required the teacher to write an exact imitation of the child's misspelt word with the accompanying verbal statement: "This is how you spelt the word". This was followed by the above modeling procedure.

The results from Experiment 1 indicated that the imitation combined strategy was more effective than the model only procedure as acquisition was more rapid and led to higher levels of performance. The same results were obtained in Experiment 2 when the subject participated in daily phonics, drills, flash card activities and written activities as well as the previously described procedures. Nulman and Gerber (1984) also presented a case study which supports the effectiveness of imitation training on the spelling performance of a learning disabled child. Gettinger (1985) has suggested that spelling acquisition and retention of "poor" spellers can be greatly improved when imitation training incorporates visual and verbal cues and is student-directed rather than teacher-directed. These variables however require further evaluation as the data base is very limited.

The Add-A-Word Spelling Programme

The Add-A-Word Spelling Programme (McGuigan, 1975) has been found to improve the spelling performance of mildly mentally retarded and behaviourally disordered children when compared to the traditional approach of weekly spelling lists and tests (Pratt-Struthers, Struthers & Williams, 1983). This method involves: (a) individualised spelling lists, (b) daily testing, and (c) daily practice in the form of copying each word on the spelling list, writing each word from memory, and comparing the student spelling of the words to the correct spelling. Pratt-Struthers et al. (1983) found that with this programme, nine learning disabled children learnt to correctly spell frequently used but misspelt words to a mean of over 90% and this generalised to creative

writing without any direct consequences for spelling accuracy. The Add-A-Word Spelling Programme may therefore be an effective remedial procedure for mentally retarded children, particularly with words commonly used by students in writing assignments.

Overcorrection Procedures

Overcorrection is the label given to a set of punishment procedures that were originally devised to control maladaptive behaviour (Foxx & Bechtel, 1982). Overcorrection has two components, which can be combined or used singly. In one component, restitution, the individual is required to correct the consequences of his misbehaviour by restoring the disturbed situation to a vastly improved state. Thus an aggressive person could be required to apologise to his or her victims. In the second component, positive practice, the individual is required to repeatedly practice appropriate behaviours in the situation in which he normally misbehaves. The procedure for aggressive behaviour would require the individual to practice appropriate social interactions with his or her victims. If the emphasis is to increase a desirable behaviour then positive practice is used alone.

Foxx and Jones (1978) used overcorrection as part of a comprehensive treatment package to remediate spelling deficits in elementary and junior high school students. Baseline instruction consisted of the usual class spelling practices, e.g., weekly spelling tests, copying a misspelt word ten times. During intervention, four experimental conditions were evaluated: (a) pretest and weekly test, (b) weekly test, overcorrection, (c) pretest, overcorrection,

weekly test, and (d) pretest, overcorrection, weekly test, overcorrection. The overcorrection procedure for each misspelt word required the student to write its correct spelling, phonetic spelling, part of speech, complete dictionary definition and correct usage in five sentences. Results indicated that all conditions that involved overcorrection procedures were associated with significantly higher student spelling performance. The final condition was the most effective (14% increase), whilst conditions three and four were nearly equivalent (11% and 10% increase in spelling performance, respectively). During the following school year, three of the four teachers continued to use overcorrection procedures and the 15 students still in the school showed maintenance of the instructional effects.

Ollendick, Matson, Esveldt-Dawson and Shapiro (1980) extended the above results in a study which used an alternating treatments design to evaluate the effects of a less complex overcorrection procedure on the spelling performance of four children with marked performance difficulties. During overcorrection the child was required to: (a) listen to the word pronounced by the teacher's aide, (b) pronounce the word correctly, (c) say aloud each letter of the word, (d) write the word correctly, and (e) repeat this sequence five times for each misspelt word. In the first experiment, overcorrection plus positive reinforcement was compared to overcorrection alone and a no-remediation control condition. In Experiment 2, overcorrection plus positive reinforcement was compared to a traditional error correction procedure (check mark) plus reinforcement and the traditional procedure when used alone. In both studies, overcorrection plus

positive reinforcement was more effective and preferred by the children.

These studies used children of average intelligence with spelling deficits. In another study, Matson, Esveldt-Dawson and Kazdin (1982) replicated the above results with one mildly mentally retarded and two borderline mentally retarded children. This study showed that overcorrection was also effective in remediating the spelling deficits of mentally retarded children and that the efficacy of the procedure could be enhanced by adding a positive reinforcement component. Stewart and Singh (1986) extended these results to four moderately mentally retarded children who were successfully taught to spell target words through a similar overcorrection procedure, which used an additional step. During overcorrection the child was required to: (a) listen to the word pronounced by the experimenter, (b) pronounce the word correctly, (c) listen to the experimenter say aloud each letter of the word, and (d) say aloud each letter of the word as he or she wrote the word correctly. This sequence was repeated five times following a misspelt word. The additional step (c) provided the child with the correct response immediately, unlike in the Ollendick et al. (1980) procedure where the child had to obtain the correct sequence of letters him or herself, which may have taken considerable time. In addition, a follow up showed that correct spelling was maintained for six months.

It would appear that overcorrection is effective in the remediation of spelling deficits in mentally retarded children through repeated practice. This is important for mentally retarded children who learn slowly and usually only

after repeated demonstrations and practice of a skill (Singh, 1985). In addition, overcorrection appears to have greater generality in its application across academic areas than other remediation procedures (Stewart & Singh, 1986). For example, it has also been found effective in the acquisition of sight vocabulary (Stringer, 1985), the remediation of oral reading errors (Singh, Singh & Winton, 1984; Singh & Singh, 1986), and the acquisition of sign-language with retarded adolescents and adults (Linton & Singh, 1984).

Interspersal Training

Interspersal training is another procedure that has been used to remediate spelling deficits in mentally retarded children. Fewer studies have been published on the efficacy of this procedure than on overcorrection. However, research suggests that it may be an effective procedure. Interspersal training refers to the procedure whereby "known items" are interspersed among test trials of unknown items. Neef, Iwata and Page (1977, 1980) demonstrated the effectiveness of interspersal training on the acquisition and retention of spelling words in six mentally retarded adolescents and three mentally retarded men, respectively.

Neef et al. (1977) concurrently introduced interspersal training and high density reinforcement in an alternating treatments design. During baseline and training conditions, when a response was incorrect the experimenter circled the incorrect letters, verbalised the correct spelling and required the student to write the word correctly three times. During interspersal training, 10 known words were alternately presented with each of 10 unknown words.

A procedure involving high density social reinforcement was later introduced during baseline and was followed by a return to the original non-interspersal baseline. During high density reinforcement, social reinforcement was non-contingently delivered to correct responding for task-related behaviours e.g., writing neatly. During all conditions, a test word was deleted and replaced after the subject had reached a learning criterion of three consecutive correct trials. Retention tests were administered for all conditions. The results showed that acquisition rate and retention during interspersal training were superior to either baseline or high-density reinforcement.

In a second study, Neef et al. (1980) attempted to provide a more thorough comparison of interspersal training and high density social reinforcement, and to evaluate the effects of using as interspersal items those words most recently learned by students during training. The same baseline condition was used and was followed with an equal duration of interspersal training and high density reinforcement in an alternating treatments design. During interspersal training 10 known words were alternately presented with each of 10 unknown words. When a subject had reached a learning criterion of five consecutively correct trials for a given word, that word was then placed in the known item pool and a new training word was then added to the list. All training and known words were rotated in this manner. Retention tests were also administered for all conditions. The results confirmed Neef et al's (1977) finding that interspersal training was more effective than high density reinforcement in facilitating acquisition of spelling and extend the

effectiveness of interspersal training regarding the retention of mastered words. It therefore appears that the inclusion of known words amongst unknown words, combined with the incorporation of mastered words as interspersal items at the point where they are mastered, clearly results in high levels of acquisition and retention of spelling for mentally retarded individuals.

Spelling Instruction for Mentally Retarded Persons

The current literature on the teaching and remediation of spelling deficits with mentally retarded children consists of a limited number of studies which demonstrate the efficacy of a small number of effective instructional procedures. Further studies on the remediation of spelling deficits in this population are warranted as spelling is increasingly included in the curriculum of mentally retarded children. Teachers require some guidance in their choice of alternative procedures to determine which ones are likely to result in optimum spelling performance of their pupils. Whilst there is somewhat more evidence to support the effectiveness of overcorrection procedures, there is no evidence to suggest that any one procedure is more effective than any other. Therefore there is a need to evaluate the comparative efficacy of these procedures when used with mentally retarded children.

The Experiments

This thesis consists of three related experiments, each of which is complete in itself. In Experiment 1, overcorrection (Stewart & Singh, 1986) was compared with interspersal training (Neef et al., 1980). In Experiment 2,

overcorrection was compared with the same overcorrection procedure but combined with interspersal training. In Experiment 3, overcorrection was compared with the correction procedure used by Neef et al. (1980) but without interspersal training. All three studies included a no-training control condition in an alternating treatments design.

Alternating Treatments Design

An alternating treatments design (Barlow & Hayes, 1979) was used for each of the three experiments. This single-subject design was used because it enables the comparison of two or more treatment procedures or interventions within one treatment session and is therefore less disruptive to the normal classroom routine. After baseline observations, two or more interventions are implemented in the same phase to alter a given behaviour. The distinguishing feature of the alternating treatments design is that the different conditions are distributed or varied across stimulus conditions in such a way that the effects of the different treatments can be separated from the influence associated with the different stimulus conditions (Kazdin, 1982). Therefore, by rapidly alternating the order of treatment procedures, any observed differences between treatments are not confounded with sequence or order effects. The design also avoids the use of a reversal phase to demonstrate functional control and is therefore more suited in the present studies as accurate spelling is not likely to return to baseline rates during reversal.

EXPERIMENT I

Studies have failed to evaluate the comparative efficacy of behavioural procedures designed to teach and remediate the spelling deficits of mentally retarded children. In this experiment, overcorrection (Stewart & Singh, 1986) was compared with interspersal training (Neef et al., 1980). Overcorrection was used since studies have clearly demonstrated its effectiveness in enhancing the spelling achievements of normal (Foxx & Jones, 1980), emotionally disturbed (Ollendick et al., 1980), mildly retarded (Matson et al., 1982), and moderately retarded children (Stewart & Singh, 1986). In addition, overcorrection appears to have wide range applicability across academic areas (Linton & Singh, 1984; Matson et al., 1982; Singh et al., 1984).

Interspersal training was selected because of its demonstrated efficacy on the acquisition and retention of spelling words in six mentally retarded adolescents and three mentally retarded men, respectively (Neef et al., 1977, 1980). The available data for alternative remedial procedures, e.g., imitation training and the Add-A-Word Spelling Programme is more limited as these procedures have been used with a smaller number of subjects.

The primary question posed was whether the two procedures, overcorrection and interspersal training, would differentially increase the spelling performance of mentally retarded children. This was evaluated using an alternating treatments design in which overcorrection was compared to interspersal training and a no-training control condition.

METHOD

Subjects and Settings

Four subjects from a local state special school for mentally retarded children participated. They were selected from three classes on the basis of having some spelling skills but were considered to require more training in this area. Spelling was not a regular classroom activity. The names of the subjects are pseudonyms in order to protect their identity.

All subjects were moderately mentally retarded according to the AAMD criteria (Grossman, 1983). Annie was a 15-year-old girl and had an IQ range of 39 to 49 on the WISC-R. Jane was an 11-year-old girl and had an IQ range of 50 to 60 on the Stanford Binet (form L-M). She received daily medication of Tegretol (200mg, twice a day) and Phenobarbitone (30mg, twice a day) for epilepsy. Her medication was kept constant during the course of the study. Neil was a 13-year-old boy and had an IQ range of 49 to 59 on the WISC-R. Andrew was a 14-year-old boy and had an IQ range of 53 to 63 on the Stanford Binet. He received daily medication of Dilantin (30mg, four times a day) and Tegretol (200mg, twice a day) for epilepsy. His medication was kept constant during the course of the study.

Subjects were individually assessed and trained, on a daily basis, in a resource room (9m x 3m). The experimenter had primary teaching and university qualifications. Training in the experimental procedures was provided before the study began.

Stimulus Materials and Response Definition

Each child was individually pretested on the Arvidson

Alphabetical Spelling List (1969). A correct spelling answer consisted of a written response in which each letter corresponded to that word from the list. This response definition was used for all experimental conditions. An initial list of 30 error words was prepared for each subject and was added to as needed during the study. Each child was tested on his/her list twice so that only words that had been misspelt in both pretest sessions were selected for training. The initial 30 words were then randomly divided into three groups of three words each and a reserve pool of 21 words. In addition, a list of three words consistently spelt correctly was selected for each child. For Annie and Neil the stimulus words were from difficulty levels 1 to 7; for Jane, levels 1-5; and for Andrew, levels 1, 2, 5 to 7. The stimulus words for each subject are presented in Table 1.

Insert Table 1 about here

Experimental Design

An alternating treatments design (Barlow & Hayes, 1979) was used to compare the effects of two training procedures (overcorrection and interspersal) and a no-training control condition.

Procedure

Training was divided into three parts. The three groups of words (labelled as List A, B, and C) were randomly assigned to the three intervention conditions (i.e., List A -- interspersal training; List B -- overcorrection; List C -- no training). The order of the training procedures was

Table 1

Stimulus Words for each Subject

List A Words		List B Words		List C Words
I. Annie				
another	guest	leather	ticket	violin
rice	teaspoon	charge	nearly	human
junior	powder	husband	question	close
were	exactly	needle	paddock	while
uncle	daughter	thing	engine	thought
children	concert	better	cushion	cloak
pretty	naughty	clear	present	feast
snow	comfortable	holiday	damage	narrow
cream	thoughtful	fairy	government	carriage
finger	puzzle	through	private	glasses
wrong	coconut	onion	thieves	postage
thunder	envelope	village	murder	accident
voice	successful	famous	interesting	
shepherd	operation	pretend	passenger	
oyster		around	strength	
pyjamas		soldier	oxygen	
saucepan		jewellery	principal	
Initial interspersal words: town, them, out				
II. Neil				
people	dentist	throw	bowl	wish
three	great	drink	robber	pussy
dinner		summer	holiday	back
learn		teacher	cream	morning
puppy		said	branch	sure
friend		around	daughter	until
letter		hurt	mower	finger
clean		milk	rabbit	clock
dirt		should	purple	growl
onion		trunk	machine	cocoa
silver		while	station	dozen
prize		uncle	upset	whistle
stream		lazy	oyster	
greedy		window	perfume	
different		spring	donkey	
cabbage		muddy	neighbour	
blanket		angry		
Initial interspersal words: you, cold, my				

Table 1 continued

List A Words		List B Words		List C Words
III. Jane				
play	family	give	uncle	water
milk	window	food	spring	fire
girl		pussy	dinner	live
camp		summer	lion	clean
name		nice	ahead	sure
tell		wind	rocky	ride
finger		must	feast	hair
snow		who	purple	
until		letter	sugar	
smoke		three	holiday	
robber		puppy	dream	
wheel		friend	kennel	
branch		body	street	
nearly		dirt	minute	
Initial interspersal words: in, am, she				
IV. Andrew				
cottage	concrete	mirror	valuable	swimming
support	orchestra	sweep	temperature	prayer
dentist	improvement	vinegar	operation	appear
lorry	blossom	canary	merrily	multiply
pyjamas	unknown	through	delicious	telegraph
bought	refreshments	nearly	visitor	daughter
jewellery	cardboard	oxygen	expensive	
might	mountainous	successful	disappear	
happen	fountain	harness	jealous	
iceberg	subtract	manufacture	continue	
quantity	delighted	shepherd	amusement	
moisture	behaviour	postage	thieves	
intelligent	electricity	increase	bandage	
realize	knowledge	election	diamond	
splendid	occupation	satisfied	neighbour	
poetry	necessary	oyster	lawyer	
exchange	embroidery	pretend	invitation	
impossible	pigeon	instrument	shoulder	
occasion	stationary	lantern	chorus	
comfortable		quarrel	appearance	
gradually		butcher	entertainment	
damage		rescue	importance	
		excitement	nuisance	
		strength	foolish	
Initial interspersal words: happy, cry, go				

randomised each day. A break of about five minutes was scheduled between training procedures. Specific instructions were provided at the commencement of each training condition to enhance discrimination of the experimental conditions (Kazdin & Hartmann, 1978). A small edible reinforcer (e.g., a toffee) was presented at the end of each daily session to reinforce the children's participation.

The study consisted of the following phases:

Baseline. Each subject was tested on his/her three groups of words for three consecutive days. The experimenter called out a word and the child was instructed to write it down, saying aloud each letter as it was written. Correct responses were followed by descriptive praise (e.g., "That's right! You have spelt that word correctly. Good!") If a word was spelt incorrectly the child was told the correct spelling and the experimenter then moved on to the next word.

Overcorrection Training. Each subject was given the following instructions: "For this set of words, I'm going to help you learn those words that you misspell by having you listen to me while I say the word aloud. Then I want you to say the word correctly, listen to me saying aloud each letter of the word and then say each letter of the word as you write it. I will get you to repeat this five times for each word that you misspell. Of course, if you spell a word correctly, I will tell you and give you lots of praise." In the over-correction procedure, the experimenter called out a word and the child wrote it down. If the word was incorrect, the child: (a) was told the word was incorrect, (b) listened to the experimenter pronounce the word correctly, (c) then pronounced the word correctly, (d) listened to the experimenter

say aloud each letter of the word, (e) said aloud each letter of the word as he/she wrote it, and (f) repeated steps (b) to (e) inclusive, five times.

Learning criterion for a given word was a correct response during three consecutive sessions. A correct response was defined as a written response in which each letter corresponded to that word from the list. Once the learning criterion for a given word was met, that word was deleted from the list and replaced with a word from the pool of unknown words.

Interspersal Training. Each subject was required to spell six words, three unknown and three that the child could spell. These were presented in an alternating order. The experimenter called out a word and the child was instructed to write it down, saying aloud each letter as it was written. Descriptive praise (e.g., "That's right! You have spelt that word correctly. Good!") was provided if the word was spelt correctly. For an incorrectly spelt word, the experimenter: (a) circled the incorrect letters written by the child, (b) said aloud each letter of the word, and (c) required the child to write the word correctly three times. In the rare case of a known word being spelt incorrectly, the subject was simply told the correct spelling and the experimenter moved on to the next word.

The learning criterion and response definition were the same as for overcorrection. Once the subject met the learning criterion on an unknown word, that word was added to his/her list of known words and an existing known word was deleted. A word from the pool of reserve words was then added to the child's list of unknown words (see Neef et al., 1980).

Control. During this condition each subject was tested on his/her third group of words under baseline conditions. If a word was correctly spelt, descriptive praise (e.g., "That's right! You have spelt that word correctly. Good!") was provided. If the word was misspelt, the child was told the correct spelling and the experimenter moved on to the next word. The learning criterion and response definition were the same as for overcorrection and interspersal training. Once learning criterion was met for a given word, the word was deleted and replaced with a word from the pool of unknown words.

Post-test. Following the three daily sessions, each subject was tested on the nine words (three from each session), in a randomized order, under baseline conditions.

Reliability

A second rater checked the subject's written responses to ensure correct scoring in each session and adherence to experimental protocol. Agreement was defined as both raters scoring a word as correct, or incorrect and agreeing that the appropriate intervention had been applied. Reliability was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying the quotient by 100. The experimental conditions were applied correctly in all sessions and a 94.5% mean accuracy (range 90-98%) was obtained in the scoring of the subjects' written responses.

RESULTS

Figure 1 presents the cumulative number of words spelt correctly in the post-tests by each subject across experimental conditions. The training conditions produced mixed

results. For Jane and Neil, the overcorrection procedure was clearly more effective than interspersal training. Jane learnt 26 words with overcorrection training and 13 words with the interspersal procedure. Similarly, Neil learnt 30 words with overcorrection training and 16 words with interspersal training. However, no clear difference emerged

Insert Figure 1 about here

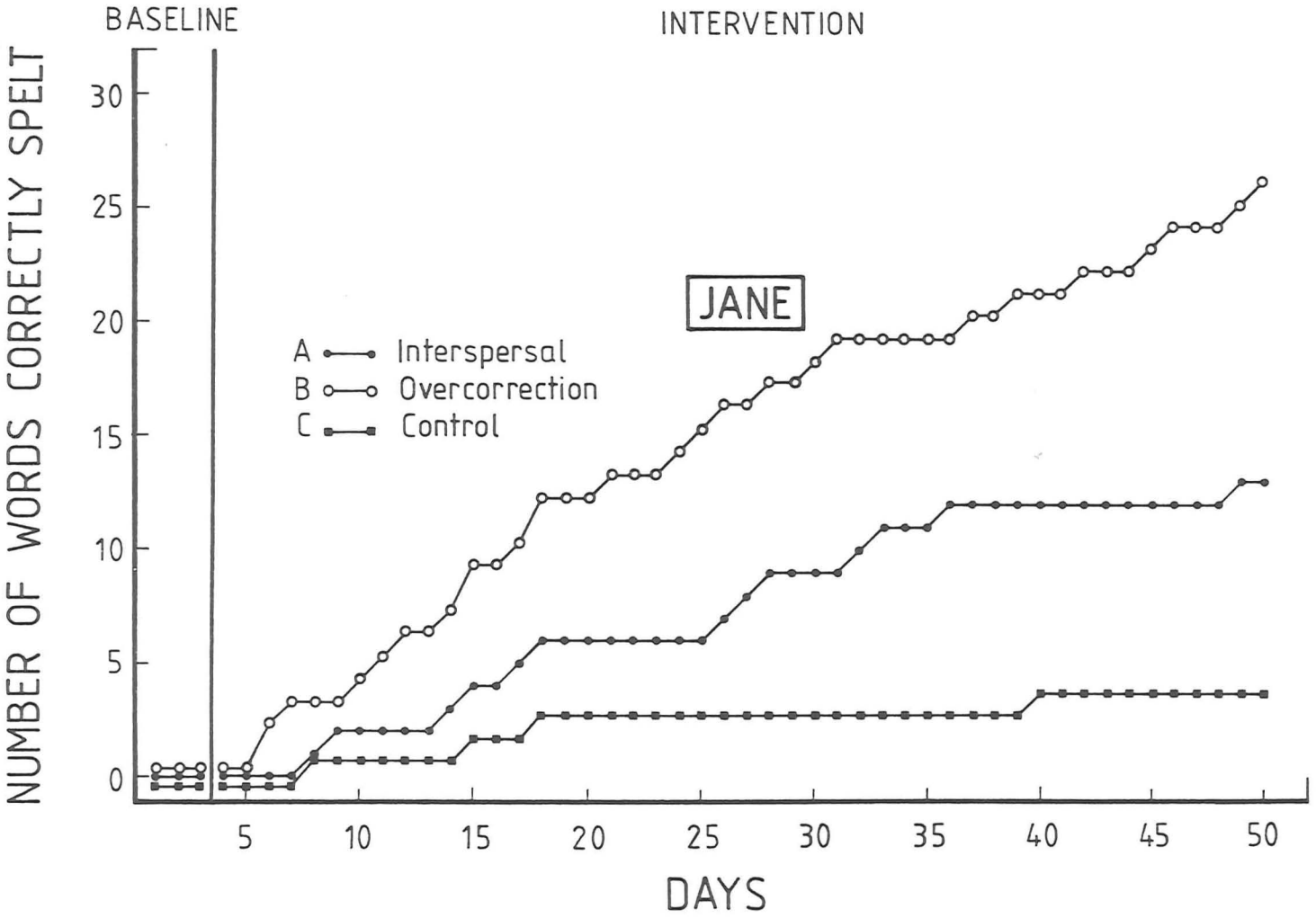
between the training procedures for Andrew and Annie. For Andrew, 45 words were learnt with overcorrection training and 40 words with interspersal training. Annie learnt 31 words with overcorrection training and 29 words with interspersal training. All subjects learnt to spell fewer words during the control condition than either of the two training procedures. Andrew, Jane, Neil and Annie learnt 3, 4, 9, and 10 words, respectively.

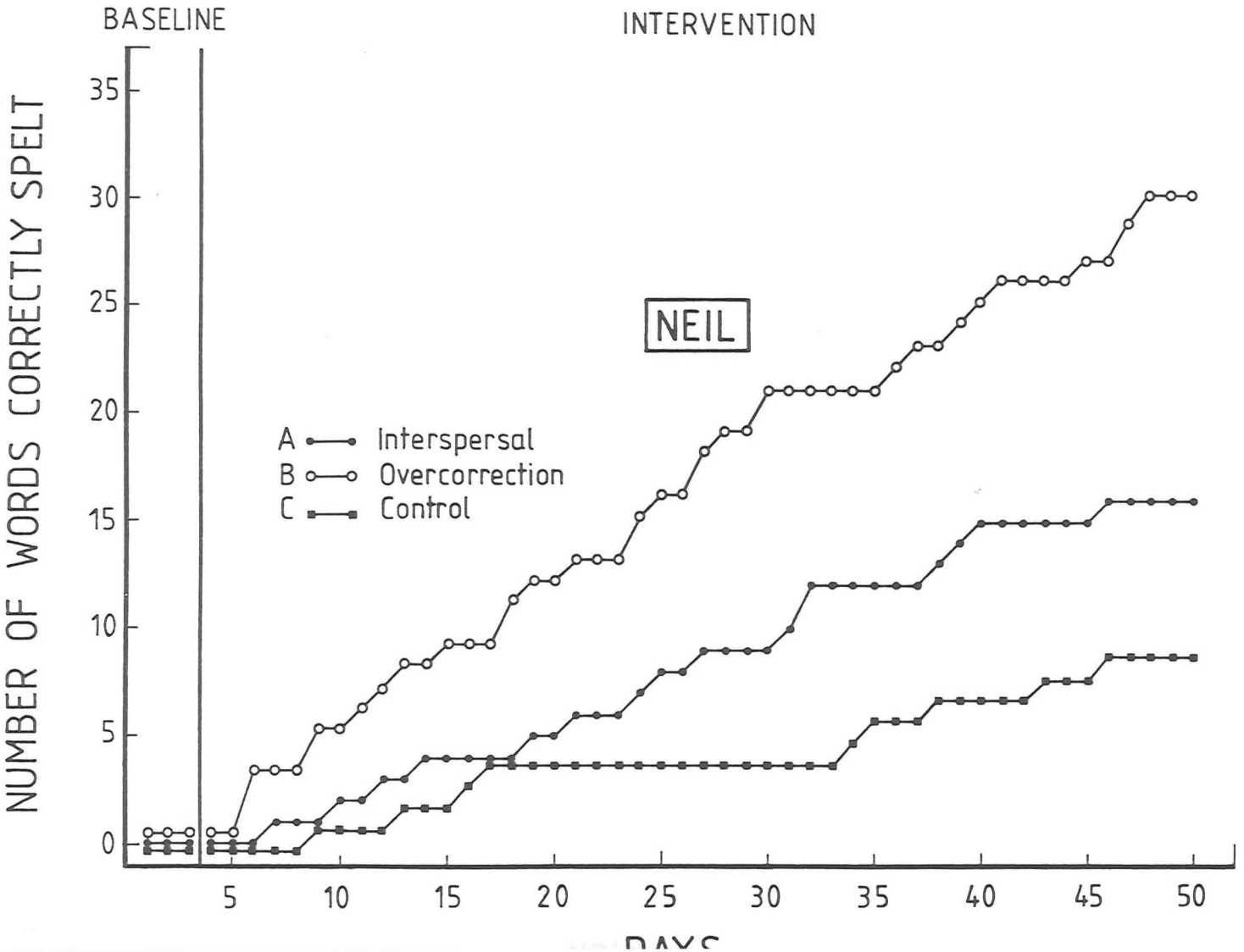
DISCUSSION

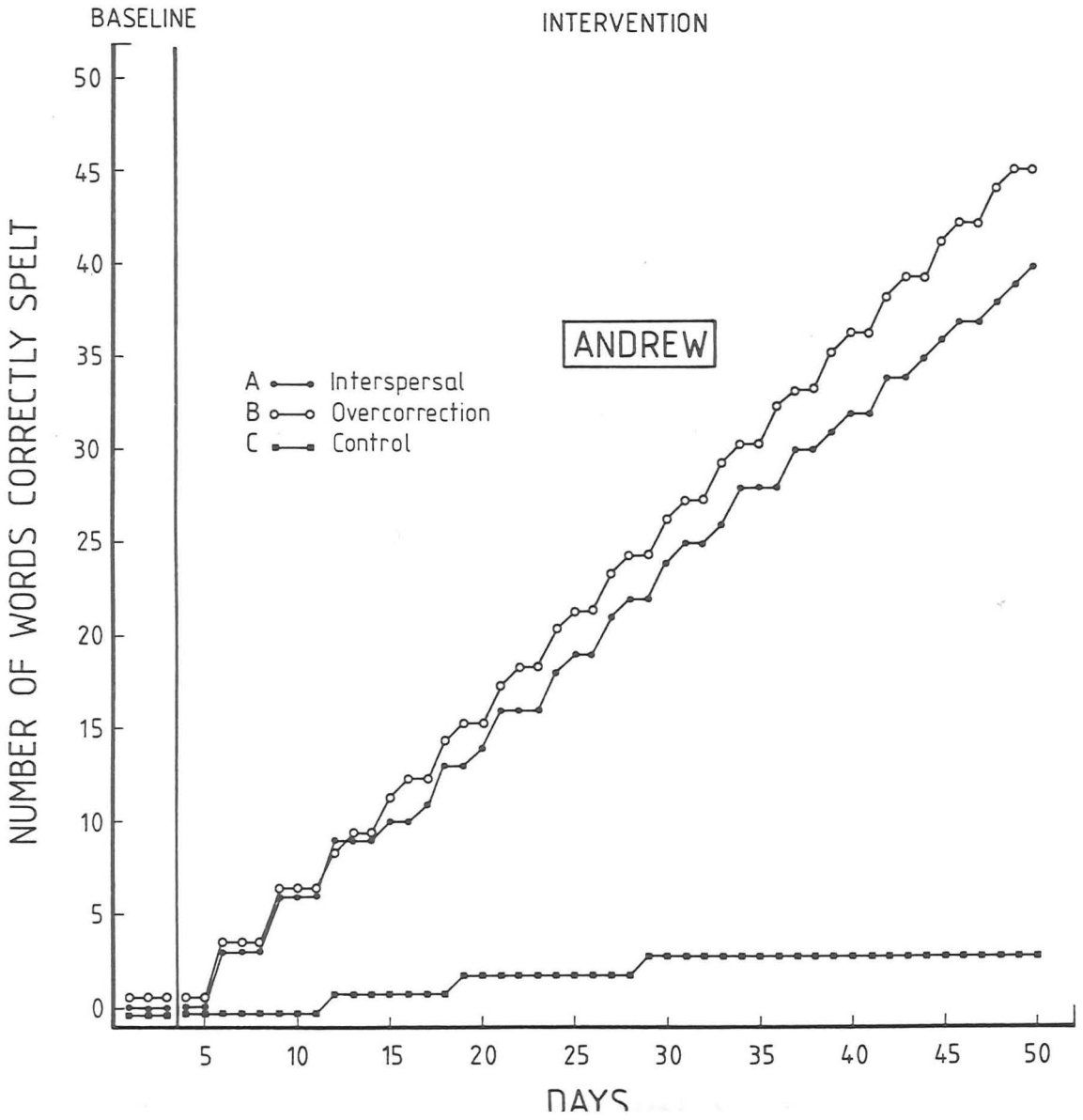
The results of Experiment 1 show that the two procedures, overcorrection and interspersal training, differentially increased the spelling performance of two of the four mentally retarded children. For Jane and Neil, the overcorrection procedure was twice as effective as interspersal training, in terms of the number of words spelt correctly. This difference across procedures emerged at the onset of the treatment phase and consistently increased during the course of the experiment, producing similar learning curves for both subjects. Both Jane and Neil could be viewed as "poorer" spellers in that they each learnt to spell fewer total words across the experiment than Andrew and Annie.

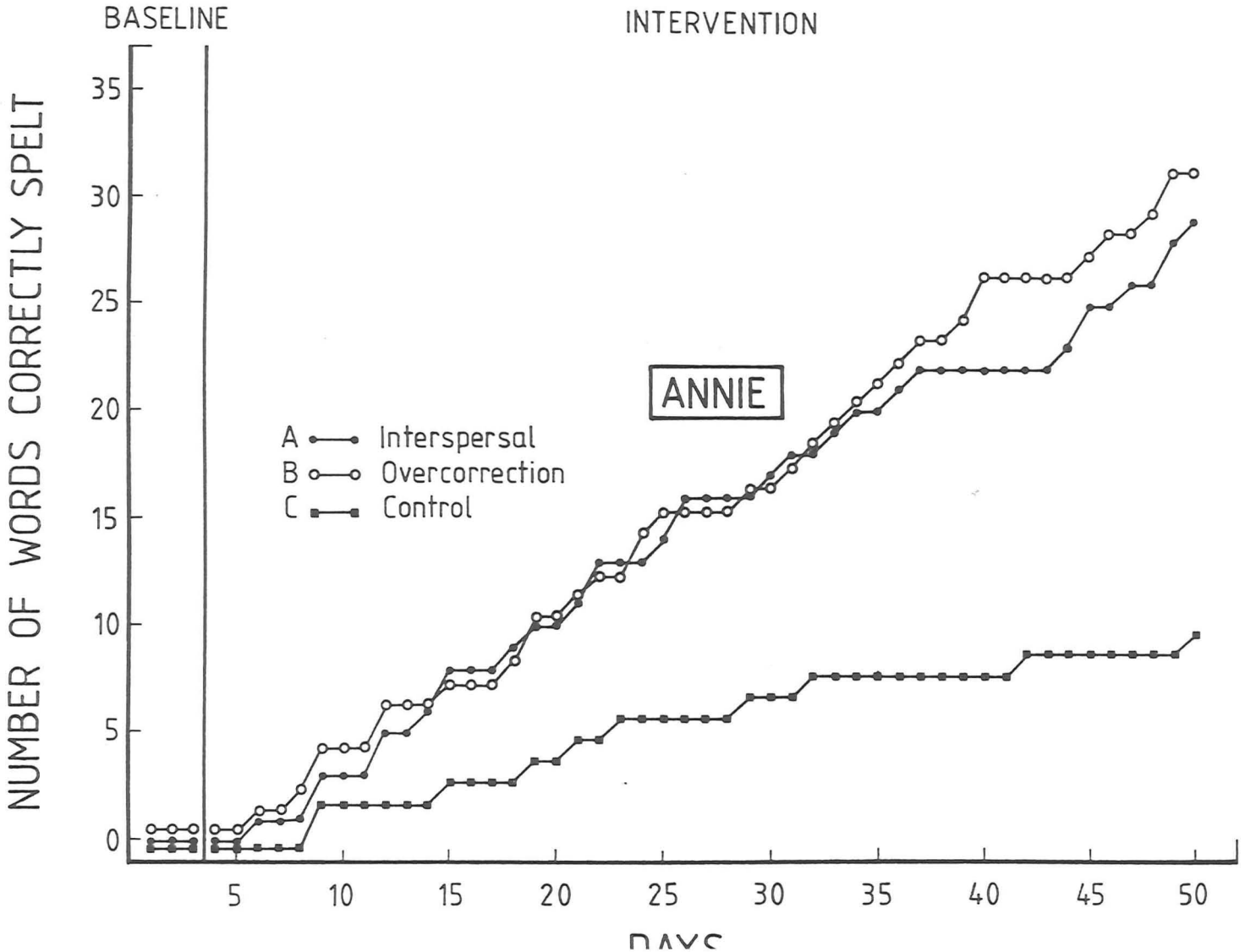
For Andrew and Annie, the two training procedures equally enhanced their spelling achievements. From the onset

Figure 1. The cumulative number of words spelt correctly in the post-tests by each subject during the baseline and intervention phases.


BASELINE
INTERVENTION
NUMBER OF WORDS CORRECTLY SPELT
30
25
20
15
10
5
0
JANE
A Interspersal
B Overcorrection
C Control
5
10
15
20
25
30
35
40
45
50
DAYS


BASELINE
INTERVENTION
NUMBER OF WORDS CORRECTLY SPELT
NEIL
A Interspersal
B Overcorrection
C Control
0
5
10
15
20
25
30
35
40
45
50
DAYS


BASELINE
INTERVENTION
NUMBER OF WORDS CORRECTLY SPELT
ANDREW
A Interspersal
B Overcorrection
C Control
0
5
10
15
20
25
30
35
40
45
50
DAYS


BASELINE
INTERVENTION
NUMBER OF WORDS CORRECTLY SPELT
ANNIE
A Interspersal
B Overcorrection
C Control
0
5
10
15
20
25
30
35
40
45
50
DAYS

of the experiment, both procedures equally increased the spelling accuracy of Andrew and Annie and remained constant across the experiment. Towards the latter part of the experiment slight differences emerged between the procedures, with overcorrection producing slightly higher spelling scores. However, these were not significant as the difference was rather small, and as they occurred only in the last ten sessions of the experiment, there is no indication that these differences would have increased across time.

Both training procedures clearly resulted in spelling gains, to some degree, for all four subjects. However, the control procedure resulted in the correct spelling of very few words. Clearly, the results show that using positive reinforcement (social praise) plus corrective feedback in the control condition was not as effective as either of the two training procedures. These results suggest that moderately mentally retarded children learn to spell new or difficult words equally well or faster through overcorrection than interspersal training.

EXPERIMENT 2

It was shown in Experiment 1 that both training procedures, overcorrection and interspersal training, produced gains in spelling achievement. For two subjects the overcorrection procedure was clearly superior to the interspersal procedure, and for the two other subjects the procedures were equally effective.

It can be speculated that the interspersal of known with unknown words, the training procedure, or their combination could have contributed to the outcome of the interspersal training procedure. Since interspersal training was as effective as overcorrection for two of the four subjects, it is clear that this procedure is effective with some children. What is not clear is the contribution of each component to the treatment outcome.

Experiment 2 was designed to test the efficacy of one of the components of the interspersal training procedure. That is, the effects of interspersing known items with unknown items was evaluated in the absence of the training procedure used by Neef et al. (1977, 1980). In Experiment 2, overcorrection was used as the training procedure in two sessions in an alternating treatments design, with a no-training control condition in the third. However, in one condition overcorrection was used as in Experiment 1, and in the other, it was used in conjunction with the interspersal of known and unknown words. That is, in this condition, the overcorrection procedure was substituted for the Neef et al. (1980) training procedure.

METHOD

Subjects and Settings

Four subjects who attended the same school as those in Experiment 1, participated. Subjects were selected from the same three classrooms on the basis of having some spelling skills but were considered to require more training in this area. Spelling was not a regular classroom activity for these children. Pseudonyms are used in this report in order to protect the identity of the subjects.

All subjects were moderately mentally retarded according to the AAMD criteria (Grossman, 1983). Claire was a 15-year-old girl and had an IQ below 45 on the WISC-R. She received daily medication of Epilum (200mg, four times a day) for epilepsy which remained constant during the course of the study. Mary was also a 15-year-old girl and had an IQ range of 42 to 52 on the Stanford Binet. Ruth was an 11-year-old girl and also had an IQ range of 42 to 52 on the Stanford Binet. Warwick was a 16-year-old boy and had an IQ range of 40 to 50 on the WISC-R.

Subjects were individually assessed and trained, on a daily basis, in the same resource room as in Experiment 1 and with the same experimenter.

Stimulus Materials and Response Definition

The same procedures were followed as in Experiment 1. That is, each child was individually pretested on the Arvidson Alphabetical Spelling List (1969). A correct spelling answer consisted of a written response in which each letter corresponded to that word from the list. This response definition was used for all experimental conditions. An initial list of 30 error words was prepared for each subject

and was added to as needed during the study. Each child was tested on his/her list twice so that only words that had been misspelt in both pretest sessions were selected for training. The initial 30 words were then randomly divided into three groups of three words each and a reserve pool of 21 words. In addition, a list of three words consistently spelt correctly was selected for each child. For Mary and Warwick the stimulus words were from difficulty levels 1 to 6, and for Ruth and Claire, from levels 1 to 5 and 1 to 4, 6-7, respectively. The stimulus words for each subject are presented in Table 2.

Insert Table 2 about here

Experimental Design

An alternating treatments design (Barlow & Hayes, 1979) was used to compare the effects of the two training procedures (overcorrection and overcorrection with interspersal) and a no-training control condition.

Procedure

The same format was followed as in Study 1. Training was divided into three parts. The three groups of words (labelled List A, B, and C) were randomly assigned to the three intervention conditions (i.e., List A -- overcorrection; List B -- overcorrection with interspersal; List C -- no training). The order of the training procedures was randomised each day. A break of about five minutes was scheduled between training procedures. Specific instructions were provided at the commencement of each training condition in order to enhance discrimination of the experimental conditions (Kazdin & Hartmann, 1978). A small edible reinforcer

Table 2

Stimulus Words for each Subject

List A Words		List B Words		List C Words
I. Mary				
gold	family	friend	wrong	teacher
was	robber	cry		cut
morning	clock	dish		farm
story	wolf	not		spend
must	sorry	glad		cabin
cold	cabbage	snow		
body	iron	letter		
day	game	bark		
but	windy	spoon		
spring	soldier	purple		
calf	horse	only		
ahead	tyre	ask		
until	brush	second		
swim		baker		
Initial interspersal words: it, my, bike				
II. Warwick				
happen	dream	rabbit	thirsty	city
water	greedy	friend	blood	said
cousin	family	give	change	teacher
will	tractor	please	trouble	music
few	clock	not	nothing	snow
pretty	pumpkin	white	warm	dentist
it	front	rice	balloon	storm
close	wolf	green	grapes	castle
farm	dozen	body	fortune	
trunk	kennel	dirt	candle	
lunch	holiday	gold	bottle	
spring	circus	ahead	vegetables	
until	leather	famous		
dish	type	garage		
bark	peanut	slide		
cabin	surprise	robber		
silver		piano		
rose		swing		
Initial interspersal words: and, bed, run				

Table 2 continued

List A Words		List B Words		List C Words
III. Ruth				
town	only	had	white	play
house	spoon	food	silver	boat
love	piano	farm	wheel	sister
took	cheese	little	pocket	soap
who	glove	make	floor	drum
run	angry	wall	lion	
water	lamb	teacher	sugar	
dive	speak	dust	rabbit	
film	tooth	bark	high	
soil	game	over	purple	
body	paper	song	slide	
glad	myself	clean	tractor	
pretty	stick	letter	knock	
spring		trunk	music	
Initial interspersal words: she, up, get				
IV. Claire				
hope	dirt	body	guess	water
cry	sour	over	wool	king
spring	clothes	friend	cocoa	run
but	daisy	ride	flower	girl
day	early	snow	brush	food
people	hand	trunk	country	clean
man	tired	train	lake	clock
only	circus	iron	blood	street
city		cousin	funny	tell
glad		copy	person	lunch
soil		star	small	
rice		farm	team	
onion		rake		
Initial interspersal words: we, big, dog				

(e.g., a toffee) was presented at the end of each daily session to reinforce the children's participation.

The study consisted of the following phases:

Baseline. The same procedure was used as in Experiment 1. That is, each subject was tested on his/her three groups of words for three consecutive days. The experimenter called out a word and the subject was instructed to write it down, saying aloud each letter as it was written. Correct responses were followed by descriptive praise (e.g., "That's right. You have spelt that word correctly. Good !"). If a word was spelt incorrectly the subject was told the correct spelling and the experimenter then moved on to the next word.

Overcorrection Training. The same procedure was followed as in Experiment 1. Briefly, the experimenter called out a word and the subject wrote it down. Correct responses were followed by descriptive praise (e.g., "That's right. You have spelt that word correctly. Good!"). If the word was incorrect, the subject: (a) was told the word was incorrect, (b) listened to the experimenter pronounce the word correctly, (c) then pronounced the word correctly, (d) listened to the experimenter say aloud each letter of the word, (e) said aloud each letter of the word as he/she wrote it, and (f) repeated steps (b) to (e) inclusive, five times.

Learning criterion for a given word was a correct response during three consecutive sessions. A correct response was defined as a written response in which each letter corresponded to that word from the list. Once the learning criterion was met for a given word, that word was deleted from the list and replaced with a word from the pool of unknown words.

Overcorrection with Interspersal Training. Each session consisted of six trials, i.e., three error words and three known words presented in an alternating order. The child was given the same instructions as for the over-correction training condition. Descriptive praise (e.g., "That's right! You have spelt that word correctly. Good!") was provided for a correctly spelt word. If the test word was spelt incorrectly the subject: (a) was told the word was incorrect, (b) listened to the experimenter pronounce the word correctly, (c) then pronounced the word correctly, (d) listened to the experimenter say aloud each letter of the word, (e) said aloud each letter of the word as he/she wrote it, and (f) repeated steps (b) to (e) inclusive, five times. In the rare case of a known word being spelt incorrectly, the subject was simply told the correct spelling and the experimenter then moved on to the next word.

Learning criterion for a given word was a correct response over three consecutive sessions. Once the child met the learning criterion for a given word, that word was added to his/her list of known words and an existing word was deleted. A word from the reserve pool of unknown or error words was then added to the child's list of unknown words.

Control. The same procedure was followed as in Experiment 1. That is, each subject was tested on his/her third group of words under baseline conditions. If a word was correctly spelt, descriptive praise (e.g., "That's right. You have spelt that word correctly. Good!") was provided. If the word was misspelt, the subject was told the correct spelling and the experimenter moved on to the next word. The learning criterion and response definition were the same

as for overcorrection and interspersal training. Once learning criterion for a given word was met, that word was deleted and replaced with a word from the pool of unknown words.

Post-test. Following the three daily sessions, each child was tested on the nine words (three from each session), in a randomized order, under baseline conditions.

Reliability

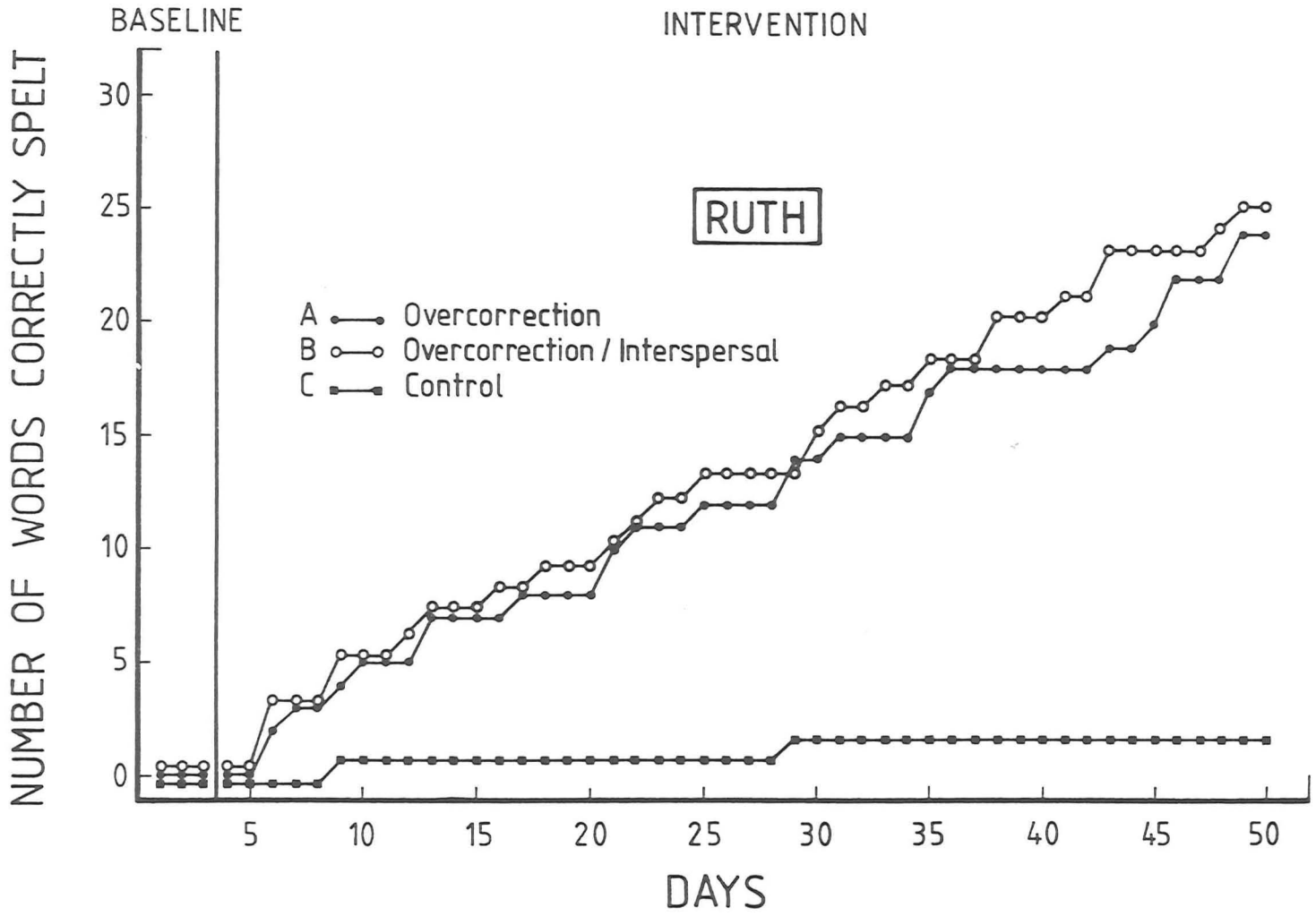
A second rater checked the subject's written responses to ensure correct scoring in each session and adherence to experimental protocol. Agreement was defined as both raters scoring a word as correct or incorrect and agreeing that the appropriate intervention had been applied. Reliability was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying the quotient by 100. The correct experimental procedures were applied in all sessions and a 96% mean accuracy (range 92%-100%) was obtained in the scoring of the subjects' written responses.

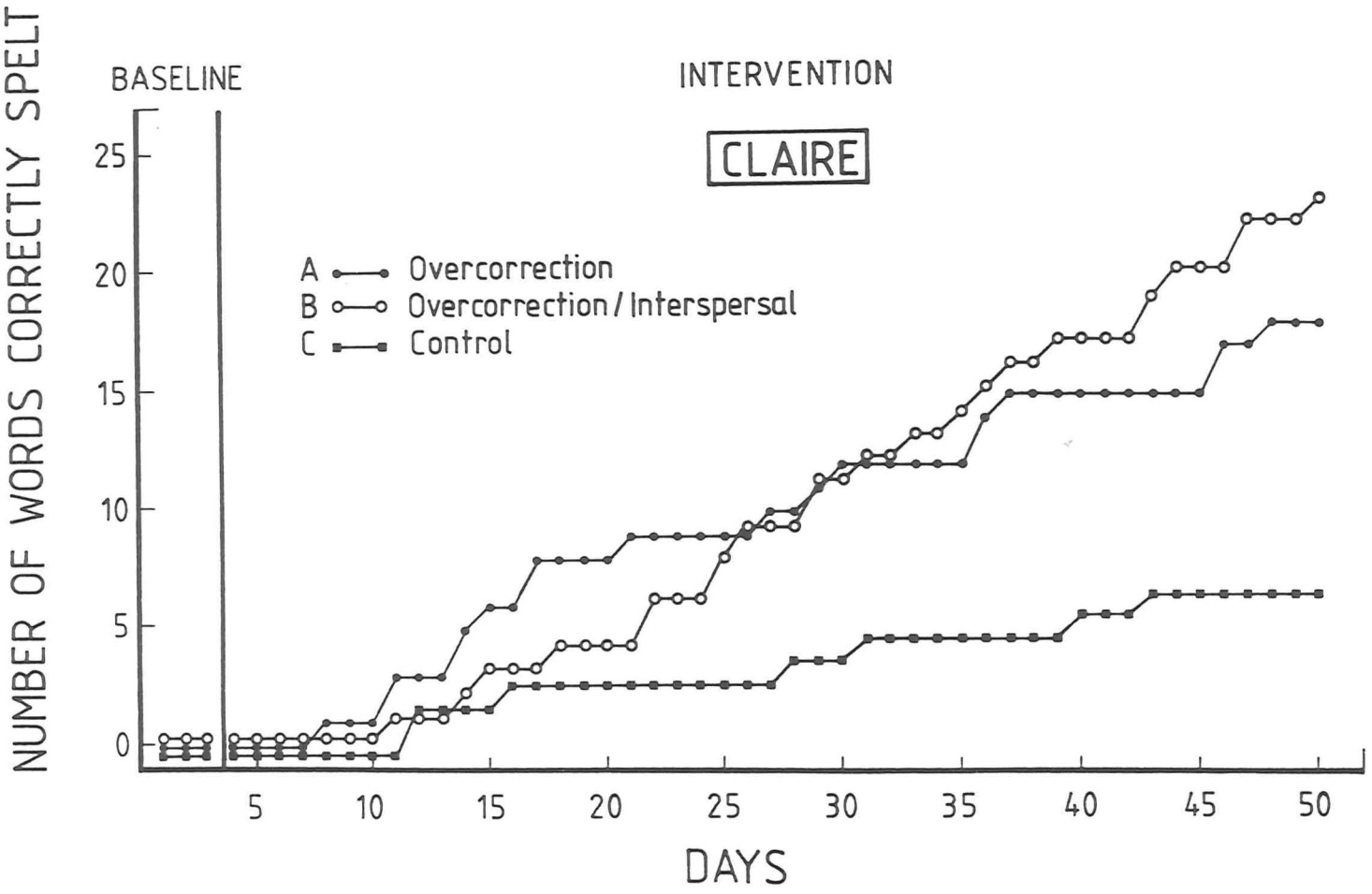
RESULTS

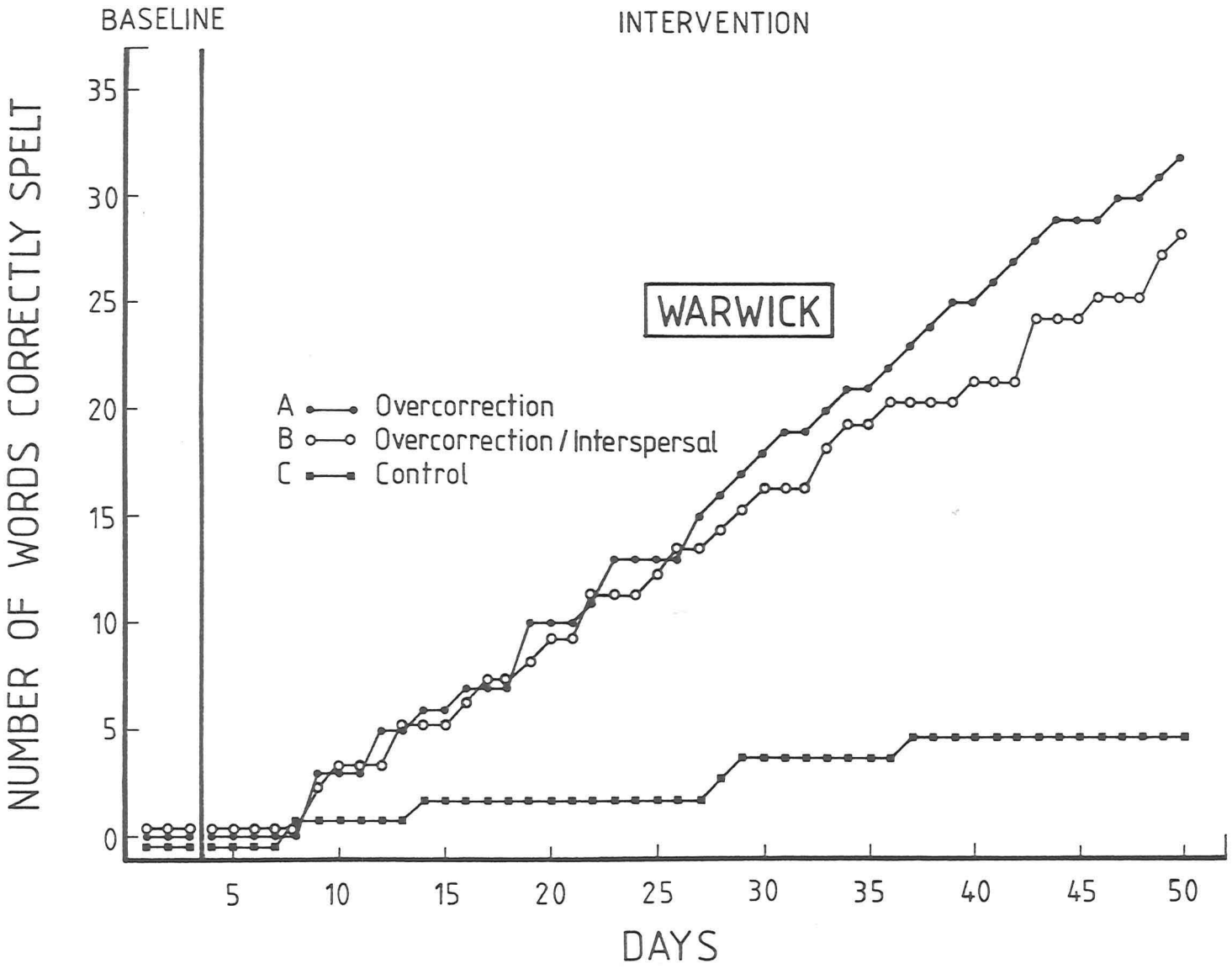
The cumulative number of words spelt correctly in the post-tests by each subject across experimental conditions are presented in Figure 2. For Ruth, Claire and Warwick no clear differences emerged between the two training procedures. Ruth learnt to spell 25 words with the combined overcorrection procedure (i.e., overcorrection with interspersal) and 24 words with overcorrection training alone. For Claire, 23 words were learnt with the combined overcorrection procedure and 18 words with overcorrection training alone. Warwick learnt to spell 28 words with the combined overcorrection procedure and 32 words with overcorrection training alone.

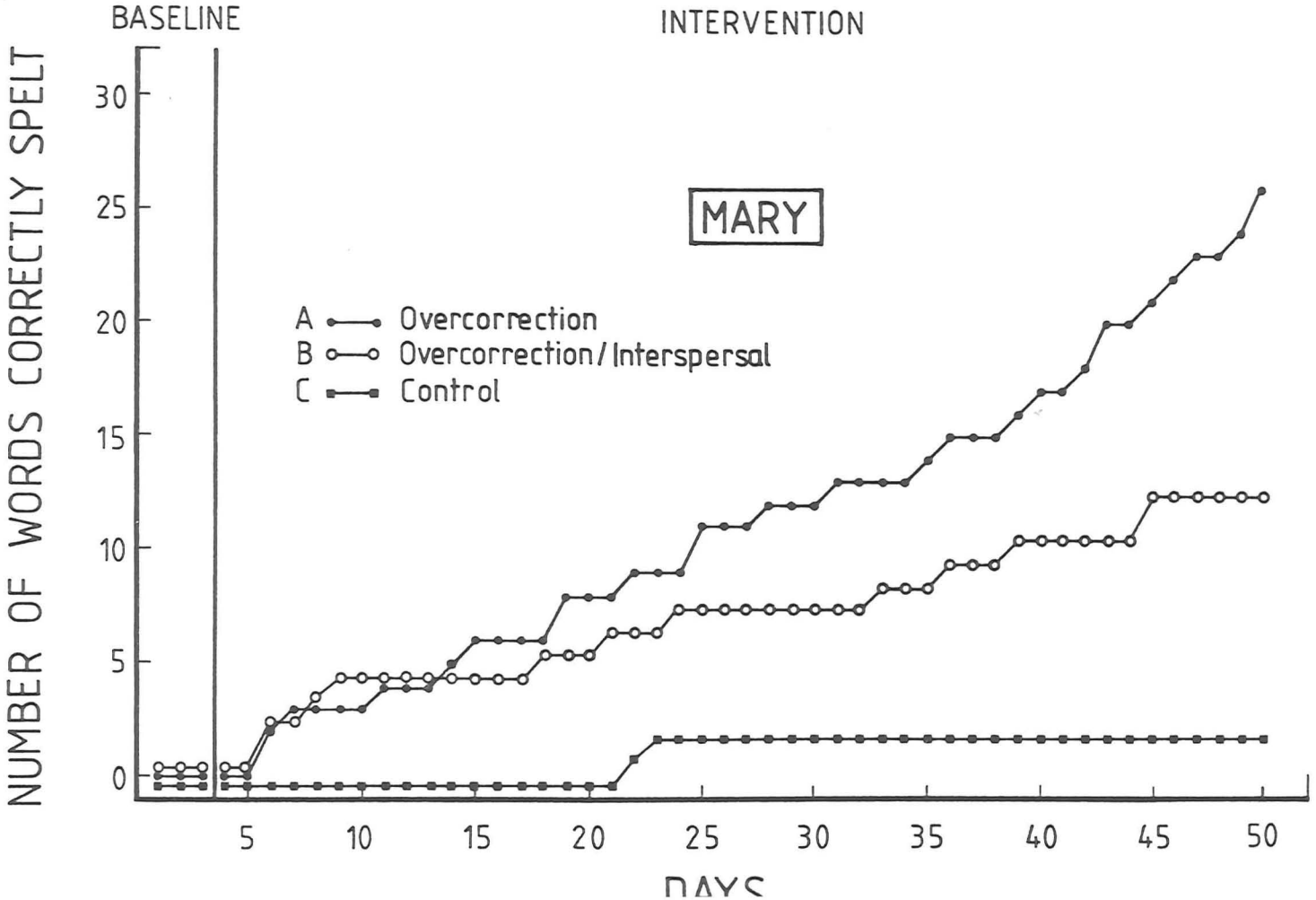
Insert Figure 2 about here

Figure 2. The cumulative number of words spelt correctly in the post-tests by each subject during the baseline and intervention phases.


BASELINE
INTERVENTION
NUMBER OF WORDS CORRECTLY SPELT
RUTH
A Overcorrection
B Overcorrection / Interspersal
C Control
0
5
10
15
20
25
30
5
10
15
20
25
30
35
40
45
50
DAYS


NUMBER OF WORDS CORRECTLY SPELT
BASELINE
INTERVENTION
CLAIRE
A Overcorrection
B Overcorrection / Interspersal
C Control
0
5
10
15
20
25
5
10
15
20
25
30
35
40
45
50
DAYS


BASELINE
INTERVENTION
NUMBER OF WORDS CORRECTLY SPELT
0
5
10
15
20
25
30
35
5
10
15
20
25
30
35
40
45
50
DAYS
WARWICK
A Overcorrection
B Overcorrection / Interspersal
C Control


BASELINE
INTERVENTION
NUMBER OF WORDS CORRECTLY SPELT
MARY
A Overcorrection
B Overcorrection / Interspersal
C Control
0
5
10
15
20
25
30
35
40
45
50
DAYS

For Mary, the overcorrection training alone procedure was considerably more effective than the combined overcorrection procedure. Mary learnt to spell 12 words with the combined overcorrection procedure and 26 words with overcorrection training alone. Of the four subjects, Mary was the poorest speller as she learnt to spell the least number of words during the experiment.

All four subjects learnt to spell only a small number of words during the no-training control condition. Ruth and Mary learnt 2 words each, while Claire and Warwick learnt 7 and 5 words, respectively.

DISCUSSION

The results strongly indicate that the addition of interspersal to the overcorrection procedure did not result in superior spelling performance when compared to overcorrection alone. As in Experiment 1, during the no-training control condition the subjects learnt the correct spelling of very few words. For Ruth, Claire and Warwick the combined procedure was equally as effective as overcorrection training alone. Overcorrection produced large gains in spelling performance and the inclusion of known words did not alter these gains and therefore failed to provide additional assistance to the three subjects with their spelling accuracy. Towards the latter third of the experiment, the two training procedures showed slight variations in spelling scores but these differences were small and showed no sign that they would increase with time. For Claire and Ruth, the combined procedure produced slightly higher spelling scores whereas for Warwick, overcorrection alone appeared more effective.

Mary was the only subject who showed a difference between the two training procedures. Overcorrection alone was clearly more effective than the overcorrection procedure with interspersal training. This difference emerged at day 19 and consistently increased across the experiment. Mary can be regarded as the "poorest" speller of the four subjects as she learnt to spell fewer total number of words across the experiment. This result correlates with Experiment 1, in which the two "poorer" spellers produced greater gains with overcorrection training than interspersal training.

In sum, it appears that the interspersal technique does not contribute significantly to the children's learning of new words. Indeed, there is some suggestion from this experiment that for "poorer" spellers the inclusion of interspersal may in fact hinder their progress.

EXPERIMENT 3

The results of Experiment 2 showed that the addition of interspersal training (the inclusion of known words) did not increase the spelling performance of the subjects when compared to overcorrection alone. Yet for two subjects in Experiment 1, interspersal training was comparable to the spelling gains obtained with overcorrection training, and also resulted in spelling gains for the other two subjects, although less than with overcorrection training. However, Neef et al's (1977, 1980) data showed that their interspersal training was an effective procedure in the acquisition of spelling by mentally retarded individuals. Experiment 2 showed that one of the two components of their procedure did not contribute significantly to training outcome. This suggests that the other component of their interspersal training may have been responsible for the reported success.

In the studies by Neef et al. (1977, 1980) a correction procedure was used when a target word was spelt incorrectly. This required the experimenter to circle the incorrect letters, verbalise the correct spelling and required the student to write the word correctly three times. This procedure was replicated in Experiment 1 of this study. It is possible that this correction procedure alone was responsible for any spelling improvements in the Neef et al. (1977, 1980) studies. In order to test this proposition, the effects of the correction procedure alone have to be isolated from those of the interspersal of known words.

Thus, in Experiment 3 the primary question posed was what direct effect the correction procedure used by Neef et al. (1977, 1980) has on the spelling performance of mentally retarded children. A second aim was to test its comparative efficacy against the overcorrection procedure used in the previous two experiments. This was evaluated using an alternating treatments design in which overcorrection was compared to the Neef et al. (1977, 1980) correction procedure (hereafter termed the "Neef procedure") and a no-training control condition.

METHOD

Subjects and Settings

Four subjects from a residential school for mildly mentally retarded children with some degree of emotional disturbance participated. Subjects were selected from the same class on the basis of having some spelling skills but were considered to require more training in this area. Spelling was not a regular classroom activity. The names of the subjects are pseudonyms to protect their identity. Mildly mentally retarded children were chosen as opposed to moderately mentally retarded children used in the other two studies because of the unavailability of suitable moderately retarded children.

All subjects were mildly mentally retarded boys according to the AAMD criteria (Grossman, 1983). Kent was 16 years old and had an IQ range of 45 to 55 on the WISC-R and a Burt Reading Test score of 6.06 to 7.03 years. Kent participated in the study for only 25 sessions, after which he permanently left school. Greg was 16 years old and had an IQ range of 63 to 73 on the WISC-R and a Burt Reading Test

score of 8.09 to 9.03 years. Gavin was 15 years old and had an IQ range of 69 to 79 on the WISC-R and a Burt Reading Test score of 6.06 to 7.03 years. Ryan was 15-years-old with an IQ range of 59 to 69 on the WISC-R and a Burt Reading Test score of 7.00 to 7.06 years. None of the boys were on medication during the course of the study.

Subjects were individually assessed and trained, three or four times per week, in a resource room (5m x 4m) adjoining the subjects' classroom. The experimenter was a post-graduate student in Psychology. Adequate training of the experimental procedures was given prior to the commencement of the study.

Stimulus Materials and Response Definition

Each child was individually pre-tested on a school spelling list entitled "Essential Words for Spelling and Writing" (see Appendix 1). This list consisted of 230 words which comprise one-half to three-quarters of the words used in most writing. The words were from levels 1 and 2 of the Arvidson Alphabetical Spelling List (1969) used in Experiments 1 and 2. A correct spelling answer consisted of a written response in which each letter corresponded to that word from the list. This response definition was used for all experimental conditions.

An initial list of 30 error words was prepared for each subject. This was added to as needed during the study. For Kent and Grant, words were also directly selected from the Arvidson Alphabetical Spelling List (1969) since these subjects could correctly spell the majority of the words from the school spelling list. Each subject was tested on his list twice so that only words that had been misspelt in both pretest sessions were selected for training. The initial 30 words were randomly

divided into three groups of three words and a reserve pool of 21 words. For Kent and Ryan, the stimulus words were from difficulty levels 1 and 2, and for Greg and Gavin, levels 1-4 and level 1, respectively. The stimulus words for each subject are presented in Table 3.

Insert Table 3 about here

Experimental Design

An alternating treatments design (Barlow & Hayes, 1969) was used to compare the effects of the two training procedures (overcorrection and the Neef procedure) and a no-training control procedure.

Procedure

The same format was followed as in Experiments 1 and 2. Training was divided into three parts. The three groups of words (labelled List A, B, and C) were randomly assigned to the three intervention conditions (i.e., List A -- Neef procedure; List B -- overcorrection; List C -- no training). The order of the training procedures was randomised each day. A break of about five minutes was scheduled between training procedures. Specific instructions were provided at the commencement of each training condition to enhance discrimination of the experimental conditions (Kazdin & Hartmann, 1978). A small edible reinforcer (e.g., a toffee) was presented at the end of each session to reinforce the children's participation.

The study consisted of the following phases:

Table 3

Stimulus Words for Each Subject

List A Words		List B Words		List C Words
I. Kent				
again	happen	other	head	through
thought	these	might	naughty	never
another	family	children	building	should
ready	country	must	second	colour
tried	between	told	picture	
many	spelling	what	Christmas	
came	heard	them	window	
there	will	afraid		
began	present	want		
nearly		together		
II. Ryan				
were	very	our	name	back
some	made	time	only	people
that	again	with	play	three
just	away	night	them	what
first	if	over	her	next
two	other	there	said	
after	more	saw	could	
when	where	came	water	
they	because	long	found	
from	which	house	heard	
III. Greg				
children	through	lorry	decide	during
leave	thanked	picture	thirteen	music
sure	bicycle	nearly	Christmas	spelling
minute	different	take	kennel	colour
ticket	surprise	know	straight	stopped
present	aeroplane	naughty	broken	trouble
weather	business	rode	autumn	hedge
between		suppose	country	against
cousin		telephone	tomorrow	
station		vegetables	swimming	
beautiful		knew		
IV. Gavin				
said	long	back	out	people
only	morning	after	get	what
just	three	thought	would	over
very	next	your	not	along
have	heard	that	more	
with	know	house	night	
about	door	him	little	
got	their	our	now	
told		from	before	
made		took	other	
you		saw	around	

Baseline. The same procedure was used as in Experiments 1 and 2. That is, each subject was tested on his/her three groups of words for three consecutive days. The experimenter called out a word and the subject was instructed to write it down, saying aloud each letter as it was written. Correct responses were followed by descriptive praise (e.g., "That's right. You have spelt the word correctly. Good!"). If a word was spelt incorrectly the subject was told the correct spelling and the experimenter then moved on to the next word.

Overcorrection Training. The same procedure was followed as in Experiments 1 and 2. Briefly, the experimenter called out a word and the subject wrote it down. Correct responses were followed by descriptive praise (e.g., "That's right. You have spelt that word correctly. Good!"). If the word was incorrect, the subject: (a) was told the word was incorrect, (b) listened to the experimenter pronounce the word correctly, (c) then pronounced the word correctly, (d) listened to the experimenter say aloud each letter of the word, (e) said aloud each letter of the word as he/she wrote it, and (f) repeated steps (b) to (e) inclusive, five times. The time taken to overcorrect a misspelt word was also recorded to establish a comparison with the Neef procedure.

Learning criterion for a given word was a correct response during three consecutive sessions. A correct response was defined as a written response in which each letter corresponded to that word from the list. Once the learning criterion for a given word was met, that word was deleted from the list and replaced with a word from the pool of unknown words.

Neef Procedure. The experimenter called out a word and the subject was required to write it down, saying aloud each letter as it was written. Descriptive praise (e.g., "That's right. You have spelt that word correctly. Good!") was provided if the word was spelt correctly. If a word was spelt incorrectly the experimenter: (a) circled the incorrect letters written by the subject, (b) said aloud each letter of the word, and (c) required the subject to write the word correctly, three times. The time taken to correct a misspelt word was also recorded.

The learning criterion and response definition were the same as for overcorrection. Once the learning criterion for a given word was met, that word was deleted from the list and replaced with a word from the pool of unknown words.

Control. The same procedure was followed as in Experiments 1 and 2. That is, each subject was tested on his/her third group of words under baseline conditions. If a word was correctly spelt, descriptive praise (e.g., "That's right. You have spelt that word correctly. Good!") was provided. If the word was misspelt, the child was told the correct spelling and the experimenter moved on to the next word. The learning criterion and response definition were the same as for overcorrection and the Neef procedure. Once learning criterion was met for a given word, that word was deleted from the list and replaced with a word from the pool of unknown words.

Post-test. Following the three daily sessions, each child was tested on the nine words (three from each session), in a randomized order, under baseline conditions.

Reliability

A second rater checked the subjects' written responses to ensure correct scoring in each session and adherence to experimental protocol. An agreement was defined as both raters scoring a word as correct or incorrect, and agreeing that the appropriate intervention had been applied. Reliability was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying the quotient by 100. The correct experimental conditions were applied in all sessions and a 100% accuracy was obtained in the scoring of the subjects' written responses.

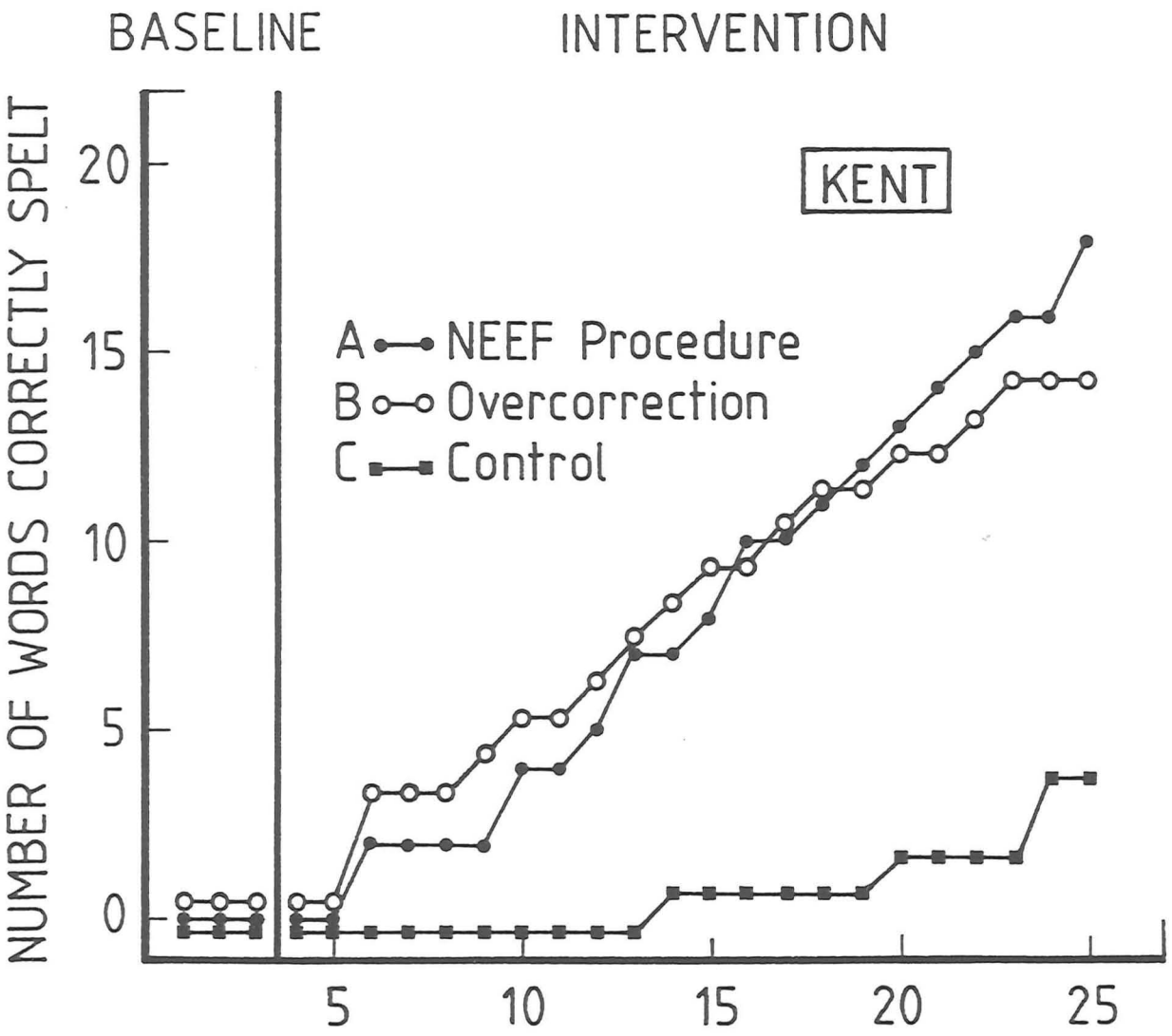
RESULTS

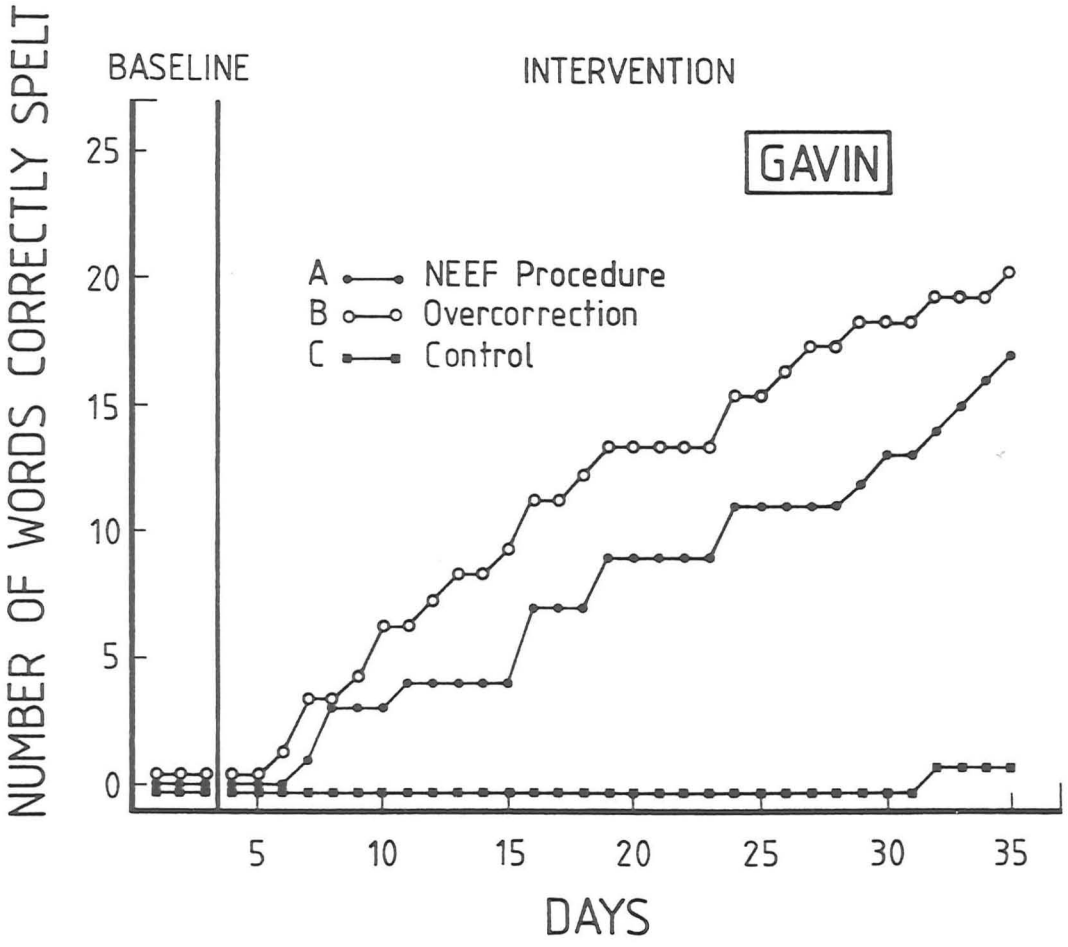
The cumulative number of words spelt correctly in the post-tests by each subject across experimental conditions are presented in Figure 3. No clear differences emerged between the two training conditions. Both procedures took about 1 to 2 minutes to implement for a misspelt word. Kent learnt to spell 18 words with the Neef procedure and 14 words with overcorrection training. For Gavin, 17 words were learnt with the Neef procedure and 20 words with overcorrection training. Ryan learnt to spell 19 words with the Neef procedure and 17 words with overcorrection training. Finally, Greg learnt to spell 15 words with the Neef procedure and 19 words with overcorrection training.

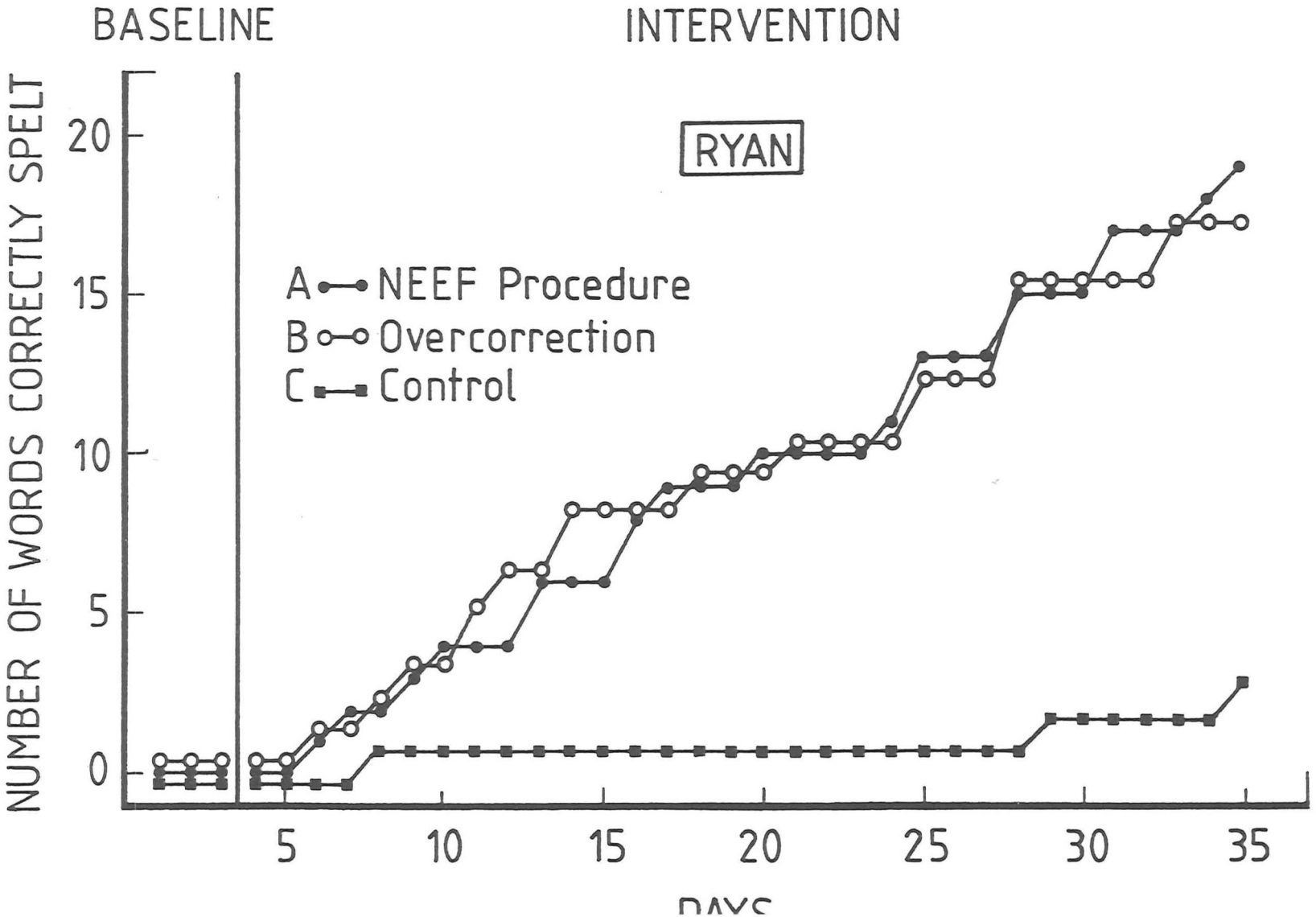
Insert Figure 3 about here

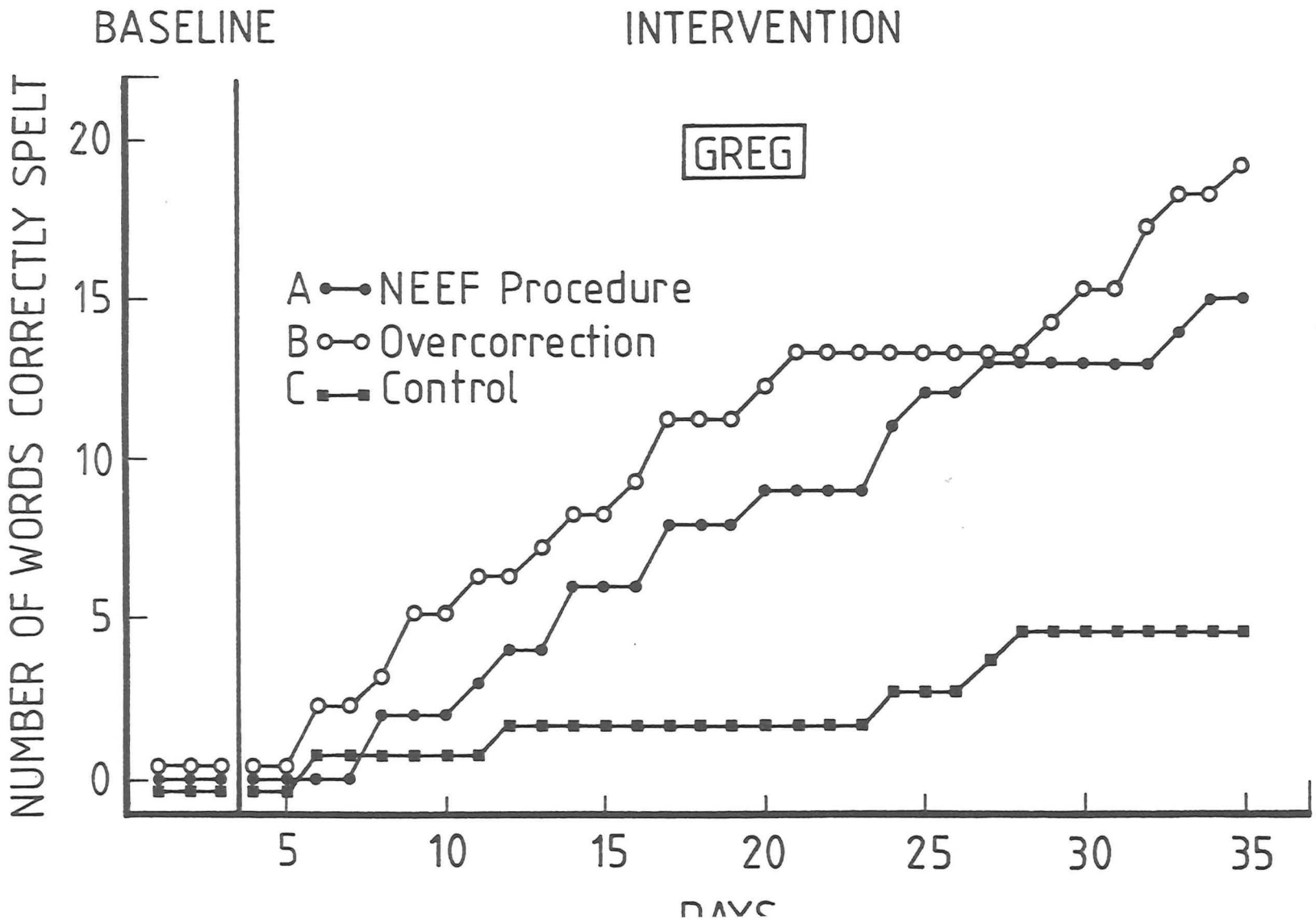
All subjects learnt to spell fewer words during the no-training control condition than in the two training conditions. Kent, Gavin, Ryan, and Greg learnt 4, 1, 3 and 5 words, respectively.

Figure 3. The cumulative number of words spelt correctly in the post-tests by each subject during the baseline and intervention phases.


BASELINE
INTERVENTION
KENT
A NEEF Procedure
B Overcorrection
C Control
NUMBER OF WORDS CORRECTLY SPELT
0
5
10
15
20
5
10
15
20
25


BASELINE
INTERVENTION
GAVIN
A NEEF Procedure
B Overcorrection
C Control
NUMBER OF WORDS CORRECTLY SPELT
0
5
10
15
20
25
5
10
15
20
25
30
35
DAYS


BASELINE
INTERVENTION
RYAN
A NEEF Procedure
B Overcorrection
C Control
NUMBER OF WORDS CORRECTLY SPELT
0
5
10
15
20
5
10
15
20
25
30
35
DAYS


BASELINE
INTERVENTION
GREG
A NEEF Procedure
B Overcorrection
C Control
NUMBER OF WORDS CORRECTLY SPELT
0
5
10
15
20
5
10
15
20
25
30
35
DAYS

DISCUSSION

For each of the four subjects, no clear difference emerged between the effectiveness of overcorrection training and the Neef correction procedure. Both procedures produced significant gains in spelling achievement. These results strongly suggest that the correction component of the Neef et al. (1977, 1980) interspersal training is an effective procedure for the improvement of spelling performance. Therefore the present results, combined with those of Experiment 2, suggest that the correction component of the Neef et al. (1977, 1980) interspersal training is responsible for any associated gains in spelling performance rather than the inclusion of known words. The overcorrection and Neef procedures were also equally effective in terms of the time required to implement each procedure. On average each procedure took 1 to 2 minutes to implement for a misspelt word.

From the beginning of the experiment, the two training procedures rapidly increased the spelling performance of the four subjects when compared to the control condition. For Kent and Ryan, the two procedures produced similar learning curves across the study. For Gavin and Greg, slight variations were observed across the two training procedures. The overcorrection procedure resulted in slightly higher spelling scores but the difference was not large and decreased by the end of the experiment for Gavin, and showed no indication of increasing for Greg.

GENERAL DISCUSSION

The primary aim of this study was to examine the comparative efficacy of two behavioural procedures, overcorrection and interspersal training, on the spelling performance of mentally retarded children. The results clearly demonstrate the effectiveness of overcorrection in increasing the spelling proficiency of these children. In addition, the results show that interspersal training is a comparatively effective remedial procedure.

In Experiment 1, the differential effects of overcorrection and interspersal training were compared against a no-training control condition. While both procedures were superior to the no-training control condition, the four moderately mentally retarded children learnt to spell new or difficult words equally well or faster through overcorrection than interspersal training. For Jane and Neil, the overcorrection procedure was twice as effective as interspersal training, in terms of the number of words spelt correctly. However, for Andrew and Annie the two training procedures equally enhanced their spelling achievements. Interspersal training is therefore clearly effective with some children. This suggests that either the interspersal of known with unknown words, the correction procedure used, or their combination could have contributed to the outcome of the interspersal procedure.

Experiment 2 was designed to evaluate the efficacy of the interspersal of known words with unknown words.

Overcorrection was compared with overcorrection used in conjunction with the interspersal of known and unknown words, and a no-training control condition. The results clearly showed that the interspersal technique did not contribute to the children's spelling proficiency. For Ruth, Claire, and Warwick the combined procedure was equally as effective as overcorrection training alone. There is some suggestion from Mary's lower spelling performance with the combined procedure, that for "poorer" spellers, the inclusion of known words may hinder their progress. This correlates with the results of Experiment 1, in which the two "poorer" spellers learnt to spell significantly more words during overcorrection than interspersal training. Clearly, the results indicate that the correction procedure used during interspersal training probably could have contributed to the outcome of the interspersal training procedure as observed in Experiment 1.

In Experiment 3, overcorrection was compared to the Neef procedure and a no-training control condition. The general aim was to evaluate the effect the correction procedure has on spelling performance, and to test its comparative efficacy against the overcorrection procedure. For all four subjects, both procedures produced significant gains in spelling achievement, and no clear difference emerged between the two. The results show that the Neef procedure enhanced the spelling performance of mildly mentally retarded children and is therefore the active component of interspersal training. In addition, the Neef procedure appeared to be equally as effective as overcorrection training and required a similar amount of time to implement.

In all three experiments of the present study, subjects learnt to spell very few words during the baseline and control conditions. For example, the greatest number of words learnt during the control condition of an experiment was in Experiment 1, where Annie learnt 10 words over 50 sessions. This confirms the results of previous studies. Stewart and Singh (1986) also introduced corrective feedback combined with positive reinforcement to the baseline condition and observed no improvement in spelling accuracy. Clearly, the provision of corrective feedback and positive reinforcement for a correct response does not provide mentally retarded children with any degree of remedial assistance for spelling deficits.

The overall results of the three experiments show that overcorrection training is a very effective procedure for the remediation of spelling deficits with both mildly and moderately mentally retarded children. However, interspersal training is a comparatively effective remedial procedure because of the correction procedure used, and not the interspersal of known with unknown words. In fact, for the "poorer" spellers the interspersal technique may have distracted or confused their spelling performance. The reason why the overcorrection and Neef procedures produced similar results is that the Neef procedure involved one of the principles of overcorrection, i.e., repeated practice. Each subject was required to repeatedly practice writing the correct spelling of a misspelt word. During the Neef procedure, this was performed three times for each misspelt word and five times during overcorrection. Clearly, the two procedures are not too dissimilar. In fact, the Neef procedure can be considered an alternative overcorrection procedure rather than a separate remedial procedure for spelling.

The results of this study confirm the findings of previous studies that successfully used overcorrection procedures to enhance the spelling achievements of normal (Foxx & Jones, 1978), emotionally disturbed (Ollendick et al., 1980), and mentally retarded children (Matson et al., 1982; Stewart & Singh, 1985). Overcorrection clearly enhanced the spelling performance of both mildly and moderately mentally retarded children, thereby confirming its effectiveness across ability levels. This adds to the growing body of literature that indicates overcorrection procedures are appropriate and effective instructional procedures to improve a variety of academic tasks across ability levels (see Singh, 1985). For the mentally retarded child who learns slowly and only with repeated practice, such procedures appear to be well suited.

Clearly, the results of this and previous studies demonstrate that active involvement is a necessary component of an effective procedure for the remediation of spelling deficits in mentally retarded children. The inclusion of known words obviously provided no assistance, instead some form of practice at spelling was more appropriate. This point was also demonstrated with the control condition whereby corrective feedback and positive reinforcement were provided. However, as children did not actively learn words, a trial and error process operated and consequently, very few words were learnt. Whilst overcorrection works well with the mentally retarded child, this may not be true for all poor spellers. Future research may need to be undertaken with other populations, e.g., learning disabled, normal and autistic children, in order to establish the generality of these findings.

Interspersal training intuitively appears an effective procedure. The concept of interspersing known with unknown words suggests that the positive reinforcement associated with correctly spelling a known word would encourage a child to carefully attend to the unknown word and consequently, spell that word correctly. However, the results of this study provide data contrary to this rationale and question the conclusions of Neef et al. (1977, 1980) that interspersal training is an effective procedure for the acquisition and retention of spelling in mentally retarded individuals.

In these two studies the interspersal of known words was used in conjunction with the Neef procedure used in Experiment 3. Therefore, the reported gains in spelling achievement cannot be attributed to the interspersal variable. According to the present study, the subjects in the Neef et al. (1977, 1980) studies should have improved their spelling performance during the baseline phase since the correction procedure was implemented. Indeed, six of the nine students in both studies did show spelling gains within the short baseline condition. However, one can only speculate as to whether the correction procedure was directly responsible for subsequent gains in spelling performance during the studies. There is also the question of why such differences emerged across the training procedures when both used the correction procedure. The obvious study to answer these questions is to compare the Neef interspersal technique, the Neef correction procedure and a no-training control condition in an alternating treatments design.

Most studies on the spelling performance of mentally retarded children have failed to provide follow-up data on

spelling retention. Stewart and Singh (1986) extended their findings with the provision of follow-up data which clearly showed the long-term maintenance of treatment gains over a period of six months. The question however arises regarding the validity of the follow-up data for an academic task like spelling. Is there any certainty that if spelling gains are maintained they are the result of the training procedure? In fact, Stewart and Singh (1986) stated that they were uncertain what variables were responsible for the maintenance they observed. The overcorrection training procedure may have assisted the children in overlearning the words and yet it is just as likely that the children used the words in other subject areas (e.g., reading) and therefore this consolidated their learning of the words. In view of the questionable nature of follow-up data in academic areas, no follow-up testing was undertaken in the present study.

A small number of instructional procedures are available to remediate spelling deficits in mentally retarded children. Teachers require some guidance in their choice of alternative procedures to determine which procedures are likely to produce the optimum spelling performance from their pupils. This may be accomplished by referring to the data from studies like this one. Another approach is through testing the efficacy of two or more procedures in the regular classroom by the class teacher. If the efficacy is about the same for two procedures then the choice must be made on some other criteria, including the time taken, ease of implementation, complexity of the task (simpler procedures are carried out with more integrity), and subject variables.

In Experiment 3, the overcorrection and Neef procedures were established as comparatively effective and were then evaluated in terms of the time taken to implement. The results indicate that a similar amount of time was required to implement each procedure and therefore the choice between the two procedures has to be based on other variables that operate in the classroom situation (e.g., ease of implementation). For example, the Neef procedure may be a more appropriate choice for a mentally retarded child with speech problems, as it does not require any verbalisation and would be easier to implement. The choice of these procedures will depend upon a number of variables that operate in the classroom environment.

The results of this study provide a clear direction for future research in the teaching and remediation of spelling deficits in mentally retarded children. The data clearly show that overcorrection is an effective procedure in enhancing the spelling performance of mildly and moderately mentally retarded children. It also appears that interspersal training is an alternative overcorrection procedure rather than a distinct remedial procedure. These results require verification with other populations e.g., learning disabled, normal, and autistic children in order to establish the generality of these findings across ability levels. Similar results would add to the already large body of evidence which supports the effectiveness of overcorrection for a number of academic tasks.

A small number of other behavioural remedial procedures are available for the teaching of spelling with mentally retarded children e.g., imitation training. Future studies should compare the efficacy of overcorrection and these

alternative procedures in the regular classroom. A data base on the comparative efficacy of various procedures needs to be established in order to identify the remedial procedures that, given the non-ideal situation of the classroom, would be more effective than others. Teachers would then be in a position to obtain the optimum spelling performance from their students.

At present, studies on the use of peers and parents as spelling tutors have been mainly restricted to children of average intelligence. Future research should evaluate the effectiveness of peer and home-tutoring programmes for mentally retarded children. The use of peers and parents as spelling tutors would be invaluable in the special education classroom where there is often not sufficient time available for one-to-one teaching, which is ideally required for many remedial procedures. Positive results have been found for mentally retarded children as tutors in some academic areas (Gerber & Kauffman, 1981), and studies suggest that parents can assist their retarded children in other academic areas, e.g., reading skills (Love & Van Biervliet, 1984). Data on the comparative efficacy of alternative procedures would also enable the implementation of the optimum teaching procedure in peer and home-tutoring programmes.

The results of this study emphasise the importance of positive reinforcement in spelling programmes. The early behavioural studies demonstrated the effectiveness of reinforcement contingencies on spelling achievement, and more recent studies have shown that the efficacy of overcorrection can be enhanced by the addition of a positive reinforcement component. The spelling gains observed with the overcorrection

and Neef procedures would have been significantly smaller if positive reinforcement had not been included in each training trial. Clearly, the provision of positive reinforcement with each training trial is important yet is often neglected in the classroom spelling curriculum. The traditional practice of the weekly spelling test is likely to provide a child with positive reinforcement only at the end of a long week of trying to learn the test words. Future research on alternative procedures needs to incorporate positive reinforcement with each training trial and needs to emphasise to classroom teachers its importance in spelling programmes.

In conclusion, overcorrection is clearly an effective procedure in enhancing the spelling performance of both mildly and moderately mentally retarded children. The procedure appears to provide mentally retarded children with the repeated practice which is essential for this population to effectively learn an academic task. The Neef procedure can be considered an alternative overcorrection procedure and as the two procedures take the same amount of time to implement, the choice between the procedures must be based on other variables (e.g., ease of implementation). These results require verification with other populations, i.e., learning disabled, normal, and autistic children in order to establish the generality of these findings. Future research should also establish a data base on the comparative efficacy of overcorrection with alternative procedures, e.g., imitation training. There is obviously no one way to teach spelling to all children but, as shown in the present study, under given circumstances some procedures would be better than others.

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APPENDIX I - Essential Words For Spelling And Writing

The 230 words in this section are the ones we use most often when we write. Together, they make up between one-half to three-quarters of most writing, so they are important.

These words have been put in four lists according to how often they are used. The words in List 1 are used most often, the words in List 2 next most often, and so on. However, it is very important that you learn to use and spell each one.

Essential List 1

a	he	of	the	up
and	I	on	then	was
for	in	said	there	we
got	it	so	they	went
had	my	that	to	when

Essential List 2

about	but	her	me	some
after	came	him	not	them
all	could	his	off	time
are	day	home	one	two
as	down	house	our	very
at	from	if	out	were
back	get	into	over	what
be	go	is	people	with
because	going	just	saw	would
big	have	like	she	you

Essential List 3

again	did	look	only	through
am	do	made	or	told
an	dog	man	other	too
around	door	more	play	took
asked	father	morning	put	us
away	first	mother	ran	water
been	found	Mr	room	way
boy	good	name	school	well
by	has	next	see	where
called	heard	night	their	which
can	know	no	this	who
car	little	now	thought	will
come	long	old	three	your

Essential List 4

air	family	last	open	take
along	fast	left	place	tell
also	few	let	read	than
always	find	life	right	these
another	food	light	road	thing
any	friend	live	round	think
ball	gave	make	run	today
before	girl	many	sat	town
best	give	men	say	tree
better	half	might	sea	tried
book	head	money	should	under
children	help	most	side	until
each	here	Mrs	small	walk
eat	how	much	something	want
end	I'm	must	sometimes	while
even	it's	never	soon	work
ever	its	new	still	year
every	knew	once	sure	yes